Samuel Khuvis — Curriculum Vitae

CONTACT INFORMATION

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EDUCATION

University of Maryland, Baltimore County, Baltimore, Maryland, USA

Ph.D., Department of Mathematics and Statistics, May 2016
Advisor: Dr. Matthias K. Gobbert
Thesis title: Porting and Tuning Numerical Kernels in Real-World Applications to Many-Core Intel Xeon Phi Accelerators

M.S., Department of Mathematics and Statistics, May 2013
Advisor: Dr. Matthias K. Gobbert
Thesis title: Efficiency Improvements in Numerical Methods for Studying Connectivity in a Model of a Pancreatic Islet of Heterogeneous Beta Cells

B.S. in Mathematics with a minor in Computer Science, May 2011

ACADEMIC/WORK EXPERIENCE

Ohio Supercomputer Center

Senior Research Software Engineer (September 2024 – Present)
- Optimize open source modeling and simulation codes for high performance execution.
- Provide consulting on code optimization, parallel programming or accelerator programming.
- Evaluate new technologies and share findings with colleagues and develop guidance for OSC clients.
- Facilitate OSC research partnerships by collaborating on proposals and resulting research projects.

Scientific Applications Engineer (October 2017 – August 2024)
- Optimize open source modeling and simulation codes for high performance execution.
- Provide consulting on code optimization, parallel programming or accelerator programming.
- Perform application builds, investigate software development tools, make improvements to software deployment infrastructure, and create user-facing documentation.

X-ScaleSolutions, Inc.

Software Engineer (February 2022 – July 2024)
- Profile and analyze performance of MPI libraries.
- Build AI stacks on AWS cloud and HPC clusters.

ParaTools, Inc.

HPC Software Engineer (May 2015 – February 2022)
- Develop and debug HPC tools.
- Port and tune scientific applications for multi-core CPUs, GPUs, and Xeon Phis.

University of Maryland, Baltimore County

Research Assistant:
- Research Assistant for UMBC High Performance Computing Facility, Spring 2014–Spring 2016 `http://hpcf.umbc.edu`.
- Research Assistant for REU: Interdisciplinary Program in High Performance Computing, Summer 2014. `http://hpcreu.umbc.edu/summer2014`. Men-

tored a group of four students working on *Pushing the Limits of the Maya Cluster*.
- Research Assistant for REU: Interdisciplinary Program in High Performance Computing, Summer 2013. http://hpcreu.umbc.edu/summer2013. Mentored a group of four students working on *Investigating Oscillation Loss in Computational Islets*.

Instructor:
- MATH 426 Introduction to Mathematical Software Packages: Matlab (Winter 2014, Summer 2014, Winter 2015)

Teaching Assistant:
- MATH 447 Introduction to Parallel Computing; lab instructor (Summer 2013, Summer 2014)
- MATH 151 Calculus I; discussion instructor (Fall 2013)
- MATH 302 Introduction to Mathematical Analysis II; grader (Spring 2012)
- MATH 404 Introduction to Partial Differential Equations; grader (Fall 2012)
- MATH 385 Introduction to Mathematical Modeling; grader (Spring 2012, Fall 2012, Spring 2013)
- MATH 430/603 Matrix Analysis; grader (Fall 2011, Spring 2013, Spring 2015)

Previous and Ongoing Projects

- hpcGPT: Enhancing Computing Center User Support with HPC-enriched Generative AI
  - Develop and benchmark a workflow to anonymize help desk tickets for use in retrieval augmented generation
  - Deploy an LLM-based service to respond to user questions
- ICICLE: Intelligent Cyberinfrastructure with Computational Learning in the Environment
  - Develop a unified reference architecture for all CI components
  - Deploy prototype environment for inference on NVIDIA Jetson edge devices using Docker and Openstack
  - Develop a tool to provision and deploy an AI application on Chameleon Cloud
- Xscale-AI
  - Build and deploy optimized models as AWS, GCP, and Docker images
- Collaborative Research: Frameworks: Designing Next-Generation MPI Libraries for Emerging Dense GPU Systems (Senior Personnel)
  - Profile and analyze performance of HPC applications
  - Co-design of HPC applications and MPI libraries
- EarthDEM: High-resolution, time-dependent topography of a changing Earth
  - Refactor and optimize a C++ remote sensing application
  - Port Matlab code for mosaicking of satellite images to Python
  - Setup CI/CD testing framework
- A Comprehensive Collaborative Center for Aeronautical Sciences Based on a Versatile Proactive Paradigm
  - Optimized Matlab code for stability analysis of hypersonic flow
  - Performance analysis and optimization of a Fortran CFD code
  - Refactor and port a Fortran code for data-driven decompositions to the GPU
- BaRRT: Buildtime and Runtime Reproducibility Tool for Software Development and Testing
  - Develop a CLI tool to track relevant information during software building and running

Skills

MATLAB, C/C++, Fortran, Python, LaTeX, MPI, OpenMP, Linux, Git, CI/CD, HPC profilers/debuggers, GPGPU, CUDA, Docker, AWS.

RESEARCH INTERESTS

Scientific computing, performance engineering, parallel computing, development operations, machine learning operations, performance analysis tool development

PUBLICATIONS

1. Joe Stubbs, Sowbaranika Balasubramaniam, Samuel Khuvis, Sachith Withana, Manikya Swathi Vallabhajosyula, Richard Cardone, Christian Garcia, Nathan Freeman, Carlos Guzman, Beth Plale, Rajiv Ramnath, and Tanya Berger-Wolf, *ML Field Planner: Analyzing and Optimizing ML Pipelines For Field Research*, Practice and Experience in Advanced Research Computing (PEARC '25), pp. 1–9, 2025.

2. Samuel Khuvis, *BaRRT: Buildtime and Runtime Reproducibility Tool for Software Development and Testing*, Proceedings of the SC'23 Workshops of The International Conference on High Performance Computing, Network, Storage, and Analysis (SC-W '23), pp. 673—676, 2023.

3. Samuel Khuvis, Karen Tomko, Scott R. Brozell, Chen-Chun Chen, Hari Subramoni, and Dhabaleswar K. Panda. *Optimizing Amber for Device-to-Device GPU Communication*, Practice and Experience in Advanced Research Computing (PEARC '23), pp. 200—205, 2023.

4. Samuel Khuvis, Karen Tomko, Jahanzeb Hashmi, Dhabaleswar K. Panda, *Exploring Hybrid MPI+Kokkos Tasks Programming Model*, IEEE/ACM Parallel Applications Workshop, Alternatives To MPI (PAW-ATM), pp. 66–73, 2020.

5. Vasileios Karakasis, Theofilos Manitaras, Victor Holanda Rusu, Rafael Sarmiento-Pérez, Christopher Bignamini, Matthias Kraushaar, Andreas Jocksch,Samuel Omlian, Guilherme Peretti-Pezzi, João P. S. C. Augusto, Brian Friesen, Yun He, Lisa Gerhardt, Brandon Cook, Zhi-Qiang You, Samuel Khuvis, Karen Tomko, *Enabling Continuous Testing of HPC Systems Using ReFrame*, Tools and Techniques for High Performance Computing. HUST 2019, SE-HER 2019, WIHPC 2019. Communications in Computer and Information Science, vol 1190. Springer, Cham.

6. Samuel Khuvis, Zhi-Qiang You, Heechang Na, Scott Brozell, Eric Franz, Trey Dockendorf, Judith Gardiner, Karen Tomko, *A Continuous Integration-Based Framework for Software Management*, Proceedings of the Practice and Experience on Advanced Research Computing (PEARC '19), pp. 28:1–28:7, 2019.

7. Jonathan S. Graf, Matthias K. Gobbert, and Samuel Khuvis, *Long-Time Simulations with Complex Code using Multiple Nodes of Intel Xeon Phi Knights Landing*, Journal of Computational and Applied Mathematics, vol. 337, pp. 18-36, 2018.

8. Aaron Walden, Eric J. Nielsen, Mohammad Zubair, John C. Linford, Izaak Beekman, Samuel Khuvis, Sameer S. Shende, Justin P. Luitjens, John G. Wohlbier, *Unstructured-Grid CFD Algorithms on Many-Core Architectures*, SuperComputing 2017, Denver, CO, USA, November 12–17, 2017. Proceedings.

9. John C. Linford, Samuel Khuvis, Sameer Shende, Allen Malony, Neena Imam, Manjunath Gorentla Venkata, *Performance Analysis of OpenSHMEM Applications with TAU Commander*, OpenSHMEM and Related Technologies. Big Compute and Big Data Convergence, OpenSHMEM 2017, Annapolis, MD, USA, August 79, 2017. Lecture Notes in Computer Science, vol 10679.

10. John C. Linford, Samuel Khuvis, Sameer Shende, Allen Malony, Neena Imam, Manjunath Gorentla Venkata, *Profiling Production OpenSHMEM Applications*, OpenSHMEM and Related Technologies. Enhancing OpenSHMEM for Hybrid Environments, OpenSHMEM 2016, Baltimore, MD, USA, August 24, 2016. Lecture Notes in Computer Science, vol 10007.

11. Samuel Khuvis, Matthias K. Gobbert, Bradford E. Peercy, *Time-Stepping Techniques to Enable the Simulation of Bursting Behavior in a Physiologically Realistic Compu-*

tational Islet, Math. Biosci., Volume 263, pp. 1–17, 2015.

12. Fernando X. Avila-Soto, Alec N. Beri, Eric Valenzuela, Abenezer Wudenhe, Ari Rapkin Blenkhorn, Jonathan S. Graf, Samuel Khuvis, Matthias K. Gobbert, Jerimy Polf, *Parallelization for Fast Image Reconstruction using the Stochastic Origin Ensemble Method for Proton Beam Therapy*, Technical Report number HPCF–2015–27, UMBC High Performance Computing Facility, University of Maryland, Baltimore County, August 2015.

13. Samuel Khuvis and Matthias K. Gobbert, *Parallel performance studies for an elliptic test problem on the Cluster maya*, Technical Report number HPCF–2015–6, UMBC High Performance Computing Facility, University of Maryland, Baltimore County, July 2014.

14. Oluwapelumi Adenikinju, Julian Gilyard, Joshua Massey, Thomas Stitt, Jonathan Graf, Xuan Huang, Samuel Khuvis, Matthias K. Gobbert, Marc Olano, Yu Wang *Real Time Global Illumination Solutions to the radiosity algorithm using hybrid CPU/GPU nodes*, Technical Report number HPCF–2014–15, University of Maryland, Baltimore County, August 2014.

15. Adam Cunningham, Gerald Payton, Jack Slettebak, Jordi Wolfson-Pou, Jonathan Graf, Xuan Huang, Samuel Khuvis, Matthias K. Gobbert, Thomas Salter, David Mountain, *Pushing the Limits of the Cluster Maya*, Technical Report number HPCF–2014–14, UMBC High Performance Computing Facility, University of Maryland, Baltimore County, August 2014.

16. Sarah Swatski, Samuel Khuvis, and Matthias K. Gobbert. *A comparison of solving the poisson equation using several numerical methods in Matlab and Octave on the cluster maya.* Technical Report number HPCF–2014–10, UMBC High Performance Computing Facility, University of Maryland, Baltimore County, June 2014.

17. David Stonko, Samuel Khuvis, and Matthias K. Gobbert, *Numerical methods to solve 2-d and 3-d elliptic partial differential equations using Matlab on the cluster maya*, Technical Report number HPCF–2014–9, UMBC High Performance Computing Facility, University of Maryland, Baltimore County, June 2014.

18. Samuel Khuvis and Matthias K. Gobbert, *Parallel performance studies for an elliptic test problem on maya 2013*, Technical Report number HPCF–2014–6, UMBC High Performance Computing Facility, University of Maryland, Baltimore County, July 2014.

19. Gemma Gearhart, Shuai Jiang, Thomas J. May, Jane Pan, Samuel Khuvis, Matthias K. Gobbert, Bradford E. Peercy, and Arthur Sherman. *Dynamics of Computational Islet Simulations: Islets with Majority Mutated Open KATP Channels Retain Bursting*, Letters in Biomathematics. [Invited paper for the inaugural issue of this journal, published originally in the Proceedings of the Sixth Symposium on BEER 2013.]

20. Gemma Gearhart, Shuai Jiang, Thomas J. May, Jane Pan, Samuel Khuvis, Matthias K. Gobbert, Bradford E. Peercy, and Arthur Sherman. *Dynamics of Computational Islet Simulations*, Proceedings of the BEER Conference for Biomathematics, October 2013.

21. Xuan Huang, Samuel Khuvis, Samin Askarian, Matthias K. Gobbert, and Bradford E. Peercy, *Coupled PDEs with initial solution from data in COMSOL 4*, Proceedings of the COMSOL Conference 2013, Boston, MA, October 2013.

22. Gemma Gearhart, Shuai Jiang, Thomas J. May, Jane Pan, Samuel Khuvis, Matthias K. Gobbert, Bradford E. Peercy, and Arthur Sherman, *Investigating Oscillation Loss in Computational Islets*, Technical Report number HPCF–2013–14, UMBC High Performance Computing Facility, University of Maryland, Baltimore County, August 2013.

23. Samuel Khuvis, *Efficiency Improvements in Numerical Methods for Studying Connectivity in a Model of a Pancreatic Islet of Heterogeneous Beta Cells*, M.S. Thesis, Department of Mathematics and Statistics, May 2013.

Conferences, Workshops and Talks

Talks:

- *HUST23*, 10th International Workshop on HPC User Support Tools, Novemeber 12, 2023.
- *Optimizing Amber for Device-to-Device GPU Communication*, 11th Annual MVAPICH User Group Conference, August 23, 2023.
- *Optimizing Amber for Device-to-Device GPU Communication*, Practice and Experience in Advanced Research Computing, July 25, 2023.
- *Exploring Hybrid MPI+Kokkos Tasks Programming Model*, The 3rd Annual Parallel Applications Workshop, Alternatives To MPI+X, November 12, 2020.
- *A Continuous Integration-Based Framework for Software Management*, Practice and Experience on Advanced Research Computing, August 1, 2019.
- *Porting and Tuning Numerical Kernels to Many-Core Intel Xeon Phi*: Minisymposium on Parallel Computing on Hybrid CPUs, GPUs, and Intel Xeon Phi, SIAM Annual Meeting, July 11, 2016.
- *Offloading Computational Kernels in Long-Time Simulations to the Intel Phi*: Minisymposium on Parallel Computing for Partial Differential Equations on CPUs, GPUs, and Intel Phi, SIAM CSE Meeting, March 17, 2015.
- *Matrix-Free Krylov Subspace Methods on Modern CPUs and Many-Core Processors*: SIAM Annual Meeting, July 10, 2014.
- *Time-stepping techniques to enable the simulation of bursting behavior in a physiologically realistic computational islet*: 2014 UMBC Graduate Research Conference, March 26, 2014.

Contributed Posters:

- *Improving the Development Workflow of the SETSM Photogrammetry Software.* SIAM CSE 2019, Spokane, WA, February 25–March 1, 2019.
- *Unstructured-Grid CFD Algorithms on Many-Core Architectures.* SIAM Parallel Processing for Scientific Computing, Tokyo, Japan, March 7—10, 2018.
- *Performance Analysis of OpenSHMEM Applications with TAU Commander.* SuperComputing 2017, Denver, CO, November 12—17, 2017.
- *Real Time Global Illumination Solutions to the Radiosity Algorithm Using Hybrid CPU/GPU Nodes.* Summer Undergraduate Research Fest, Baltimore, MD, August 6, 2014.
- *Pushing the Limits of the Maya Cluster.* Summer Undergraduate Research Fest, Baltimore, MD, August 6, 2014.
- *Coupled PDEs with initial solution from data in COMSOL 4.* 2013 COMSOL Conference, Boston, MA, October 9–11, 2013.
- *Investigating Oscillation Loss in Computational Islets.* Summer Undergraduate Research Fest, Baltimore, MD, August 7, 2013.
- *A Review of Occupancy Problems and their Applications with a MATLAB Demo.* Summer Undergraduate Research Fest, Baltimore, MD, August 5, 2009.

Honors and Awards

Best Paper Award, PEARC25, July 2025

Best Paper Award, PEARC19, August 2019

SIAM Student Chapter Certificate of Recognition, April 2016

UMBC Premier Award, Fall 2007

Extracurricular Activities

IEEE HPEC technical committee 2022-Present

US-RSE Conference 2023 reviewer

NSF review panel 2021

Artifact Description/Artificat Evaluation committee for SC19 and SC20.

Treasurer: City of Columbus Toastmasters, 2018–2019.

President: UMBC SIAM Student Chapter, 2014–2016.

Webmaster: UMBC Mathematics and Statistics Graduate Student Association, 2013–2016.

Treasurer: UMBC Pi Mu Epsilon and Mathematics/Statistics Council of Majors, 2009–2011.