

# Mátyás A. Sustik

Mathematician, Computer scientist, Software engineer 512.507.5322 ★ msustik@gmail.com

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Demonstrated expertise in developing, implementing, testing and maintaining state of the art algorithms in several large scale production systems. These include neural network compiler scheduling, compiler optimization, convex optimization, linear algebra computations, anomaly detection, logic circuit transformations and data compression.

Read and utilize research literature and publish new contributions. Stay up-to-date with emerging technologies, including the mathematics of quantum computing. Collaborate well with other professionals, both internal and external to the organization. Successfully led a team of data scientists by providing result-oriented technical leadership. Enjoy mentoring interns and junior staff.

Willing and capable to work with existing and legacy code bases and tools in tandem with the development of new algorithms and applications. Take pride in writing efficient and well-documented software with stability and scalability in mind, including numerical and scientific computations based on research literature. Enthusiastically embrace open source when it serves the business objectives.

- ★ **Industry expertise:** compiler optimization and scheduling; numerical optimization; logic circuit modeling, simulation and verification; machine learning, data science and analytics
- ★ **Core skills:** optimizing compiler, graph transformations, mathematical optimization, linear algebra and matrix computations, algorithm development, software design, quantum circuits
- ★ **Technical competencies:** Linux, C/C++, Python, PyTorch, Fortran, LAPACK, Qiskit, Git, Gdb, Valgrind, Perf, Docker

## PROFESSIONAL EXPERIENCE

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### Solutions Editor — The College Math Journal

NOV 2023—PRESENT

Select and prepare solutions for publication. Collaborate with section editors and manage reviewers.

### Principal Compiler Engineer — Qualcomm

SEP 2021—JUL 2023

Researched and developed scheduling algorithms for the Hexagon DSP *neural network compiler*.

- ★ Invented a *directed acyclic graph ordering* optimization procedure to reduce memory utilization resulting in over 20% performance gain.
- ★ Implemented a rapid algorithm prototyping framework in C++ and Python to improve the data graph scheduler of the compiler. The solution was integrated with the regression and testing environment and as a framework it garnered the interest of other projects.

### Data Science Manager — Walmart

JUL 2016—SEP 2021

Led and mentored a team of data scientists to deliver *scientific software* used in big data tasks such as automated product *pricing, anomaly detection, forecasting*. Ensured correctness, scalability and performance via sound testing and release processes.

- ★ Launched a new anomaly detection initiative that eliminated major pricing errors.
- ★ Led the transition to a Kafka streaming infrastructure. Increased the number of transactions that could be handled tenfold. Increased the pricing update frequency threefold.

## Data Scientist — Walmart

JAN 2014—JUN 2016

Implemented a *convex optimization* algorithm derived using Lagrangian duality and a structure exploiting *linear algebra* computation used in an interior point method used in large scale price optimization. Paid special attention to numerical accuracy, stability, scalability and performance.

## Software Engineer — IBM

MAY 1998—JAN 2014

Developed a graph database and its API representing *large scale logic circuits* that supported compiler optimizations, simulator model build and formal verification.

- ★ Quadrupled the database capacity to accommodate ever increasing circuit sizes using tightly packed bit fields and a trie implementation used for hierarchical strings.
- ★ Improved stability and provided application development aid by extending a debug version of the database with additional API checks.
- ★ Wrote a 40+ page API documentation that included code examples and debugging strategies for the client applications.

Developed a *compiler optimization* application that transformed circuit designs used by software and hardware-assisted simulators and a formal verification engine. This included graph traversals, topological ordering, boolean expression rewriting and common subexpression elimination among others.

- ★ Invented a graph transformation that allowed the existing two-value simulator to perform three-value simulations with only minor modifications. This dramatically reduced development efforts and testing requirements.

Developed a novel simulation trace *compression library* that achieved 300x size reduction that combined novel dictionary-based pattern redundancy recognition, hashing and integer compression. Implemented a custom optimized trie structure that provided wildcard filtering of hierarchical signal names.

## EDUCATION

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### PhD in Computer Science — University of Texas at Austin

*Structured Numerical Problems in Contemporary Applications*

### MS in Mathematics — ELTE Science University of Budapest, Hungary

*Use of Extenders for Large Cardinal Hypotheses*

## ADDITIONAL EXPERIENCE

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### Actuary; Chief Actuary — AEGON

SEP 1995—APR 1998

Carried out mortality and financial simulations, reserve and *future value calculations*. Designed a pension investment and life insurance product.

### Teaching Assistant — BME and ELTE Universities

4 SEMESTERS, SEP 1991—MAY 1996

Led discussions and prepared exams for electrical engineers in *calculus, geometry and algebra*, and for mathematicians in *classical algebra, linear algebra and algebraic geometry*.

## PUBLICATIONS

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**Anomaly Detection for an E-commerce Pricing System**, with J. Ramakrishnan, E. Shaabani, C. Li, *Proceedings of the 25th ACM SIGKDD International Conference on Knowledge Discovery & Data Mining (KDD)*, 2019.

**Prioritized constraint handling techniques for solving optimization problems**, with J. Ramakrishnan, *US Patent App. 15/671,846*; 2019.

**Thompson sampling for dynamic pricing**, with R. Ganti, Q. Tran, B. Seaman, *arXiv preprint arXiv:1802.03050*; 2018.

**QUIC: Quadratic Approximation for Sparse Inverse Covariance Matrix Estimation**, with C. J. Hsieh, I. S. Dhillon P. Ravikumar, *Journal of Machine Learning Research (JMLR)*, 2014.

**On a Zero-Finding Problem Involving the Matrix Exponential**, with I. S. Dhillon, *SIAM Journal on Matrix Analysis and Applications (SIMAX)*, vol. 33, no. 4, pages 1237–1249, December, 2012.

**GLASSOFAST: an efficient GLASSO implementation**, with B. Calderhead, *UTCS Technical Report TR-12-29 2012*, 2012.

**Robust Partitioning for Hardware-Accelerated Functional Verification**, with M. D. Moffitt, *Design Automation Conference (DAC)*, 2011.

**Automatic Performance Model Synthesis from Hardware Verification models**, with R. Bell, *International Conference on Performance Engineering (ICPE)*, 2011.

**Low-Rank Kernel Learning with Bregman Matrix Divergences**, with B. Kulis, I. S. Dhillon, *Journal of Machine Learning Research (JMLR)*, vol. 10, pages 341–376, February 2009.

**String Searching over Small Alphabets**, with J S. Moore, *Technical Report TR-07-62, Department of Computer Sciences, University of Texas at Austin*, 2007.

**On the Existence of Equiangular Tight Frames**, with J. A. Tropp, I. S. Dhillon, and R. W. Heath Jr., *Linear Algebra and its Applications*, vol. 426:2-3, pages 619–635, October 2007.

**Generalized Finite Algorithms for Constructing Hermitian Matrices with Prescribed Diagonal and Spectrum**, with I. S. Dhillon, R. W. Heath Jr. and J. A. Tropp, *SIAM Journal on Matrix Analysis and Applications (SIMAX)*, vol. 27:1, pages 61–71, May 2005.

**Proof of Dickson’s Lemma Using the ACL2 Theorem Prover via an Explicit Ordinal Mapping**, *Proceedings of the 4th International Workshop on the ACL2 Theorem Prover and Its Applications*, April 23, 2003.

## EXTRACURRICULAR

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Journal and conference reviewer (*ICML, NIPS*).

Maintainer of open source *QUIC* and *GLASSOFAST*.

Curate mathematical competition problems as an *AIME* and *AMC* board member to give back following a successful high school math competition career that included participation at the *IMO*.

Ballroom dancing, skiing, yoga, disc golf.