Nathaniel T. Stemen

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Summary

Research engineer experienced in quantum error mitigation, circuit compilation, and translating quantum research into practical tools for NISQ devices. Lead developer of `mitiq`, a widely-used open-source Python library for error mitigation. Passionate about building open-source tools that enable the next generation of quantum computers.

Education

University of Waterloo MMath in Applied Mathematics 2020–2022

- Thesis: *Quantum Circuit Compilation from the Ground Up* advised by Joel Wallman

New York University B.Sc. in Mathematics and Physics 2013–2017

- Thesis: *An Investigation of Q-Balls* advised by Luciano Medina

Employment

Member of Technical Staff Unitary Foundation *Mar* 2022–

- Lead developer for the open-source **Python** package `mitiq` (250,000+ downloads, 130+ citations). Drive both technical innovation and strategic roadmap development to enhance performance and adoption of quantum error mitigation.
- Developed a calibration module to match error mitigation techniques and parameters to the characteristics of users' quantum hardware.
- Delivered talks on quantum error mitigation and resilience at conferences and seminars including PyData, SciPy, QuSoft, and IPN Mexico, as well as a tutorial at IEEE QCE.
- Led community-building efforts in quantum computing, including directing unitaryHACK 2023 (70 hackers, 99 issues closed, $11,000+ distributed) and serving as chair organizer for the Workshop on Error Resilience in Quantum Computing (WERQ.SHOP), convening researchers to shape the roadmap for error-resilient quantum systems over the next 5 years.

Software Developer Overleaf 2017–2021

- Improved LaTeX autocomplete using statistical analysis of open-source documents, enhancing user experience for 300,000+ daily users.
- Maintained and optimized large **Rails** and **Node** applications through bug fixes, performance improvements, and feature delivery.
- Monitored and supported data migration from **PostgresQL** to **MongoDB**.

Summer Researcher New York University 2016

- Used **Python** to numerically solve nonlinear Schrödinger equations modeling electromagnetic pulse propagation in nonlinear media.

Summer Researcher Yale University (PROSPECT Experiment) 2014 & 2015

- Built an optical simulation in **C++** to optimize detector design and study light collection and uniformity.
- Implemented pulse-shape discrimination techniques in **Python** to improve neutrino event selection.

Publications

1. LaRose, R. et al. (Aug. 2022). Mitiq: A software package for error mitigation on noisy quantum computers. *Quantum* 6, p. 774. URL: https://doi.org/10.22331/q-2022-08-11-774.
2. McDonough, B. et al. (2022). "Automated quantum error mitigation based on probabilistic error reduction". In: *2022 IEEE/ACM Third International Workshop on Quantum Computing Software (QCS)*, pp. 83–93. arXiv: 2210.08611 [quant-ph].
3. Ashenfelter, J. et al. (2016). Background Radiation Measurements at High Power Research Reactors. *Nucl. Instrum. Meth.* A806, pp. 401–419. arXiv: 1506.03547 [physics.ins-det].
4. Ashenfelter, J. et al. (2015). Light Collection an Pulse-Shape Discrimination in Elongated Scintillator Cells for the PROSPECT Reactor Antineutrino Experiment. *JINST* 10.11, P11004. arXiv: 1508.06575 [physics.ins-det].

Teaching

Fundamentals of University Teaching University of Waterloo 2020–2022
- Completed program designed to help graduate students learn evidence-based strategies for teaching through workshops and practice teaching sessions.

Mathematics Teacher NYU Metro Center College Prep Academy 2015–2017
- Independently planned and taught Pre-Calculus course for high school students.
- Facilitated numerous extra-curricular math courses of 30 students as a class assistant by providing additional guidance to students.

Service

IEEE QCE 2025 Workshop organizer Quantum Software 2.1 2025
WERQSHOP Chair Organizer https://werq.shop 2025
SciPy 2025 Reviewer 2025
QED-C mentor 2023–2024
Equity, Diversity and Inclusion Committee University of Waterloo; IQC 2021–2022
Strategic Plan Implementation Working Group University of Waterloo 2021

Continuing Education

CSE 599C: Quantum Learning Theory University of Washington (audit) *Jan–Mar* 2025
CSE 534: Quantum info. and computation University of Washington (audit) *Sep–Dec* 2024
Quantum Machine Learning Workshop QSciTech-QuantumBC *Jan–Feb* 2022
Presenting Data and Information Edward Tufte *Nov* 2019

Tools

Languages
- Python, JavaScript, SQL, Ruby, bash

Software
- git/GitHub, docker, Linux, MacOS, LaTeX

Quantum
- SDKs: Cirq, Qiskit, pyQuil, Qibo