

# FILIP MAZUREK

✉ [filip@filipmazurek.com](mailto:filip@filipmazurek.com)   [www.filipmazurek.com/](http://www.filipmazurek.com/)   [github.com/filipmazurek](https://github.com/filipmazurek)   [orcid.org/0000-0003-1121-8622](https://orcid.org/0000-0003-1121-8622)

I am a third-year Ph.D. student in Electrical and Computer Engineering at Duke University with a focus on Quantum Computing. My dissertation work aims to utilize novel statistical techniques in evaluating both classical and quantum computer processors and improving quantum computer calibration techniques based on statistical results. I am also working in the startup Avenu, which is building a better experience for nightlife goers and vendors.

## EDUCATION

Duke University	Ph.D.	🏛️ Electrical & Computer Engineering	📅 Expected May 2025	📖 GPA: 3.84 / 4.00
Duke University	B.S.	🏛️ Computer Science	📅 May 2018	📖 GPA: 3.78 / 4.00

## RESEARCH EXPERIENCE

Research Assistant	Duke ECE	📅 Aug 2020 – Present	📍 Durham, NC
Quantum Computing Research Advisor: Professor Kenneth Brown My research focuses on control system software for trapped-ion quantum computers. <ul style="list-style-type: none"><li>&gt; Developing DAX.Program-sim, a simulation framework which integrates with physical trapped-ion quantum computers at Duke. It runs simulations with the same error characterization as the systems themselves, which allows output comparison between system and simulator for better system characterization and calibration.</li></ul>			
Classical Computer Architecture Research Collaborators: Professors Daniel Sorin, Miroslav Pajic, Yu Wang <ul style="list-style-type: none"><li>&gt; Creating a statistical methodology for rigorous processor evaluation.</li><li>&gt; Inserting variability into gem5 computer simulation</li></ul>			

Research Intern	Argonne National Lab	📅 May 2020 – Aug 2020	📍 Chicago, IL
Advisor: Dr. Yuri Alexeev <ul style="list-style-type: none"><li>&gt; Worked with a project team to create a quantum computer simulator based on tensor network contractions and optimized for QAOA.</li><li>&gt; Identified algorithms which find an approximately optimal elimination order of tensor network nodes</li><li>&gt; Created automated benchmarks to investigate the effects of tensor network pre-processing on finding a good node elimination order</li></ul>			

Engineering Research Technician	CDC / NIOSH	📅 May 2015 – Aug 2015	📍 Morgantown, WV
Advisor: Dr. Jeffrey Reynolds The Center for Disease Control (CDC) is the US national health protection agency. NIOSH is the occupational health branch. <ul style="list-style-type: none"><li>&gt; Used Matlab machine learning to optimize classification parameters for rat breathing data in an investigation to parametrize the effects of silicosis on breathing.</li><li>&gt; Found that each dataset required specific calibration depending on breathing chamber.</li></ul>			

## PROJECTS

Two-Qubit Gate Calibration
<div>Python</div> <div>Qiskit</div>
> (in progress) Create a better calibration process for two-qubit gates in larger semiconductor-based quantum computers.

gem5 Simulator Variability
<div>Python</div> <div>C++</div> <div>gem5</div>
Variability exists when running benchmarks on real classical computers. Similar variability can be induced in simulation for more accurate microarchitectural analysis. <ul style="list-style-type: none"><li>&gt; Multi-threaded programs can display variability in simulation when tiny (0-4 cycles) latencies are added to DRAM access times.</li><li>&gt; Single-threaded programs require realistic contention to display good variability. Contention can be modeled after the CPU/memory pressure "fingerprint" in expected cases.</li><li>&gt; (in progress) Creating a patch for the gem5 simulator to include variability in DRAM accesses for both classic and Ruby caches.</li></ul>

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## Statistics for Processor Evaluation Framework

Python statistics

- > Create a statistical analysis framework to analyze system executions until a desired confidence is reached.
- > (*in progress*) open-source the statistics framework

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## GUI for Processor Evaluation Statistics

Python Tkinter

- > (*in progress*) To foster adoption of the statistics framework, creating an open-source graphical program which automates the statistical analysis step.

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## Quantum Experiment Software Controls Setup

Python real-time

- > Used the DAX (Duke Artiq Extensions) framework to set up experiment control for a sympathetic-ion cooling experiment.
- > Control system includes control for multiple laser frequency modulators, ion trap electrodes, and a power supply, among others. All are under real-time constraints for experimental timing.

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# WORK EXPERIENCE

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### Advisor / Senior Engineer

Avenu

March 2020 – Present

Remote

*Avenu is a startup focused on event promotion. I have been building the technical side of the company.*

- > Migrated the backend to a more flexible framework while building the application infrastructure
- > Interviewed and led a team of 8 student interns over summer 2020 to build Avenu's mobile application
- > Implemented a standard set of Agile procedures to bring structure to the engineering department
- > Provide feedback and technical advice for building investment pitch decks

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### UX Designer

Appian

Aug 2018 – Aug 2019

McLean, VA

*Appian is a low-code platform as a service which specializes in quick deployment for enterprise applications simultaneously on web and mobile.*

- > Created detailed wireframes and interactions for new features as an expert on iOS and Android application design
- > Conducted user testing and research to iterate on feature design
- > Developed training courses on user testing for UX Designers and Product Managers to standardize procedure within the company

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### Software Engineer Intern

Appian

May 2017 – Aug 2017

McLean, VA

- > Built a product feature to simplify polling and pulling data, and then to display it in a custom layout. Used Java.
- > Presented the new feature to the founders, senior engineers, and customers during Appian's quarterly release demo day

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# PUBLICATIONS

- > Filip Mazurek, "Statistics for Processor Evaluation," *Under Submission*
- > Aniket Dalvi, Filip Mazurek, Leon Riesebois, Jacob Whitlow, Swarnadeep Majumder and Kenneth R. Brown, "Modular Architecture for Classical Simulation of Quantum Circuits," *2022 IEEE International Conference on Quantum Computing and Engineering (QCE)*, 2022.

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# TEACHING

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### Teaching Assistant

Duke University

2017 – 2023


Durham, NC

- > ECE 553: Compilers (Spring 2023)  
Instructor: Andrew Hilton
- > ECE/CS 250: Computer Architecture (Fall 2021)  
Instructor: Tyler Bletsch
- > ECE/CS 250: Computer Architecture (Spring 2018)  
Instructor: Benjamin C. Lee
- > ECE/CS 250: Computer Architecture (Fall 2017)  
Instructor: Daniel Sorin
- > ECE/CS 250: Computer Architecture (Spring 2017)  
Instructor: Tyler Bletsch

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## Teaching Assistant

**Qubit x Qubit**

 Sep 2021 – May 2022

 Remote

*Qubit by Qubit is a quantum computing education startup. It operates outreach projects for students who might otherwise not have access to such opportunities.*


Led 60-student lab section for a 2-semester long course: Introduction to Quantum Computing. Taught students new material and led discussion.

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## Makers Club

**Duke University**

 Sep 2016 – May 2017

 Durham, NC

Created and led twice-monthly technology workshops which focused on creating practical devices. Taught CAD, 3D printing, Arduino coding with breadboards, and Raspberry Pi use.