

About me

I am a PhD candidate in Applied Mathematics at the University of Arizona, where my research applies probabilistic and statistical modeling to power grid systems; I am eager to leverage this expertise, along with my skills in AI/ML, operations research, and advanced modeling techniques (including NLP, diffusion models, and large language models) to applications in quantitative finance such as portfolio optimization, risk-neutral valuation, and data-driven decision-making.

Skills

- **Machine Learning & Data Science:** Supervised learning (classification & regression), Unsupervised learning (clustering, PCA), Natural Language Processing (sentiment analysis of financial news)
- **Statistical & Econometric Analysis:** Hypothesis testing and confidence interval estimation, Panel data analysis, Volatility modeling (GARCH, stochastic volatility models), Time-series modeling (ARIMA, GARCH), Monte Carlo modelling, Regression analysis (linear, logistic, LASSO, Ridge)
- **Programming:** Proficient in Julia, Python, SQL and R. Elementary proficiency in Excel, Ruby, C and C++

Internships

- **Computer Science Graduate Internship Program, Los Alamos National Lab, New Mexico** June 2023 - August 2023, January 2025 - August 2025
 - Developed a Julia based model of Electrical Power Grid dynamics for single discrete-time faults to test power system's resilience.
 - Examined and checked LANL's *System Agnostic Localization of Oscillations* (SALO) algorithm on small, medium and large power system models. Implemented a Julia based algorithm to efficiently process and test SALO's accuracy for large/dense models.
 - Built an R based visualization tool to process and render interactive dashboards used to interpret the collected data from SALO's output on large systems.
 - Developed a Julia/Python based engine *N1Plus* of Transmission Level Power Grid dynamics for multiple continuous-time faults. Built a dynamic yet analytically tractable framework for real-time security assessment to ensure system's safety and reliability.
 - Validated *N1Plus* on multiple models each with 100,000 scenarios in sub-second times. Achieved strong agreement with direct benchmark simulations.

Research experience

- **Case Studies in Applied Mathematics, Data Science/Machine Learning on Dynamic Systems at UArizona** August 2023 - Present
 - Developed numerical solvers employing stochastic models to simulate network dynamics (Power/Infrastructure, Transportation/Mobility, Communications). Defined continuous measures of network stress/damage.
 - Performed stochastic and ergodic analysis of network's dynamics using high-order sampling techniques (Importance Sampling, Cross-Entropy Method, Kullback-Leibler Maillard Sampling)
- **Research Assistant, Energy Systems at UArizona** January 2024 - July 2024
 - Developed and implemented an SDE model of IEC Power Grid to assess grid's solidness under a variety of tripping/damage on the system, resulting in the creation of a simple yet efficient sampling engine that highlights and measures the likelihood and location of overloads in the power grid.

Education

- **PhD in Applied Mathematics, Program in Applied Mathematics Tucson, Arizona** August 2022- Present
 - **Relevant Completed Courses:** Methods for Applied Mathematics, Theoretical Foundations of Applied Mathematics, Algorithms
 - **Expected Graduation:** May 2027
 - **Accomplishments:**
 - Received the 'University Fellows Award 2022-2023'
 - Participated in the '2024 Analysis of Partial Differential Equations summer graduate school' at the Okinawa Institute of Science and Technology
 - Participated in the '2025 Grid Science Winter School and Conference' by LANL's Center for Nonlinear Studies in Santa Fe, NM
- **Major in Applied Mathematics, School of Sciences UNAM, Ciudad Universitaria, Mexico City** August 2016 - January 2021
 - **Relevant Completed Courses:** Applied Mathematics Analysis, Statistics I, II & III, Stochastics Processes I & II, Numerical Optimization, Multivariate Analysis, Stochastic Simulation and Partial Differential Equations
 - **Thesis:** 'The Spectral Analysis of Switching Diffusion Processes and their Applications'
 - **Accomplishments:**
 - Received the 'UNAM-Santander Study Abroad Scholarship 2020-2021' to study in Canada