Nicholas Moehle

Work

2021–2022 **Quantitative Strategist**, *Goldman Sachs Quantitative Investment Strategies*.

I work with several investment teams in the quantitative investment strategies group (QIS) to solve novel portfolio construction and optimization problems. Selected projects:

- Created a custom, fast optimizer (from scratch) and accompanying backtester. Both were backpropagation (auto-grad) compatible to enable sensitivity analysis and gradient-based machine learning
- Wrote an optimization engine to route incoming client flows to different tax-managed products

2018–2021 **Research Fellow**, *BlackRock AI Labs*.

My primary role was to apply convex optimization and machine learning to practical problems throughout BlackRock, with a special interest in optimal investment problems. I worked closely with Stanford professors Stephen Boyd, Rob Tibshirani, Trevor Hastie, Mykel Kochenderfer, and Emmanuel Candès

Selected projects:

- Built the optimization engine for BlackRock's tax-managed equity SMA product
- Created convex optimal control algorithms for retirement planning and target date funds
- Wrote a suite of statistical outlier detection tools using low-rank models for an Aladdin data quality initiative

Other achievements:

- Wrote four academic papers and four patent applications (pending)
- Gave several presentations to Larry Fink (CEO), Rob Kapito (President), Rob Goldstein (COO), and board members
- Hosted three company-wide research seminars
- Worked closely with BlackRock thought leaders Ronald Kahn and Andrew Ang

2014 **Software Engineering Intern**, *Google*.

I implemented control algorithms for renewable energy applications

Education

2011–2018 **PhD, Mechanical Engineering**, *Stanford University*, *GPA – 4.04*.

- Advised by Stephen Boyd
- Thesis Title: *Control of Electric Motors and Drives via Convex Optimization*

2006–2010 **BS, Mechanical Engineering**, *University of California, Berkeley*, *GPA – 3.74*.

Teaching

Instructor
- Convex Optimization I (EE364A), Stanford, 2016

Teaching Assistant
- Stochastic Control Short Course, Chinese University of Hong Kong, Shenzen, 2017
- Convex Optimization II (EE364B), Stanford, 2014
- Convex Optimization I (EE364A), Stanford, 2014
- Introduction to Linear Dynamical Systems (EE263), Stanford, 2013
- Introduction to Optimal Control Theory (AA203), Stanford, 2013
- Feedback Control Design (ENGR105), Stanford, 2013

Computer

Languages Python, Julia, MATLAB, C

Other Linux, LaTeX

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Publications

Nicholas Moehle, Mykel J Kochenderfer, Stephen Boyd, and Andrew Ang. Tax-aware portfolio construction via convex optimization. *Journal of Optimization Theory and Applications*, 2021.

Nicholas Moehle, Stephen Boyd, and Andrew Ang. Portfolio performance attribution via Shapley value. Journal of Investment Management, 2022.

Nicholas Moehle. Risk-sensitive model predictive control. American Control Conference, 2022.

Nicholas Moehle and Stephen Boyd. A certainty equivalent Merton problem. IEEE Control Systems Letters, 2021.

Reza Takapoui, Nicholas Moehle, Stephen Boyd, and Alberto Bemporad. A simple effective heuristic for embedded mixed-integer quadratic programming. *International Journal of Control*, 93(1):2–12, 2020.

Nicholas Moehle, Xinyue Shen, Zhi-Quan Luo, and Stephen Boyd. A distributed method for optimal capacity reservation. *Journal of Optimization Theory and Applications*, 182(3):1130–1149, 2019.

Nicholas Moehle, Enzo Busseti, Stephen Boyd, and Matt Wytock. Dynamic energy management. In *Large Scale Optimization in Supply Chains and Smart Manufacturing*, pages 69–126. Springer, 2019.

Bartolomeo Stellato, Goran Banjac, Paul Goulart, Alberto Bemporad, and Stephen Boyd. OSQP: An operator splitting solver for quadratic programs. *Mathematical Programming Computation*, pages 1–36, 2020.

Nicholas Moehle and Stephen Boyd. Value function approximation for direct control of switched power converters. In *Conference on Industrial Electronics and Applications*, pages 360–367. IEEE, 2017.

Matt Wytock, Nicholas Moehle, and Stephen Boyd. Dynamic energy management with scenario-based robust MPC. In *American Control Conference*, pages 2042–2047. IEEE, 2017.

Nicholas Moehle and Stephen Boyd. Maximum torque-per-current control of induction motors via semidefinite programming. In *Conference on Decision and Control*, pages 1920–1925. IEEE, 2016.

Nicholas Moehle and Stephen Boyd. Optimal current waveforms for switched-reluctance motors. In *Conference on Control Applications*, pages 1129–1136. IEEE, 2016.

N. Moehle and S. Boyd. A perspective-based convex relaxation for switched-affine optimal control. *Systems & Control Letters*, 86:34–40, 2015.

Nicholas Moehle and Stephen Boyd. Optimal current waveforms for brushless permanent magnet motors. *International Journal of Control*, 88(7):1389–1399, 2015.

Nicholas Moehle and Dimitry Gorinevsky. Covariance estimation in two-level regression. In *Conference on Control and Fault-Tolerant Systems*, pages 288–293. IEEE, 2013.