Exponent®
Engineering & Scientific Consulting

Jacob Fine, Ph.D.
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Professional Profile

Dr. Fine has extensive experience developing precision control systems from the ground up and across all phases of the project lifecycle. He has expertise in all stages of the development process, from creating the dynamic models and hardware-in-the-loop environments needed to safely test a controller before deployment to tuning and debugging systems in real time. Paired with a background in hands-on prototyping, he leverages experience in multibody simulation, data-driven model refinement, and control theory to understand how and why systems fail. He has applied his expertise to multiple projects involving renewable energy systems, ranging from lab-scale prototypes to grid-scale devices.

Before joining Exponent, Dr. Fine completed his Ph.D. in mechanical engineering at the University of Michigan. His work there was split into two areas: designing controllers to maximize the energy generated by renewable energy systems and developing design optimization strategies to maximize the economic performance of energy systems when faced with uncertainty. While pursuing his Ph.D., he worked as a controls engineering consultant for PacMar Technologies, designing, testing, and deploying the control system for an autonomous underwater energy-harvesting system. In his free time, Dr. Fine coaches a middle school Science Olympiad team in the Wind Power event, enthusiastically teaching the next generation of engineers the fundamentals of renewable energy.

Academic Credentials & Professional Honors

Ph.D., Mechanical Engineering, University of Michigan, 2025

B.Eng., Mechanical Engineering, Vanderbilt University, 2021

Vanderbilt Curb Scholar for Creative Leadership, 2017-2021

Prior Experience

Controls Engineering Consultant, PacMar Technologies, 2023

Professional Affiliations

ASME Energy Systems Technical Committee

International Energy Agency Task 48 Technology Collaboration Programme

Publications

Fine J, Newell P, Govindarajan K, McGuire C, Paris P, Matthias G, Maceda M, Baxter J, Granlund K, Bryant M, Vermillion C. Analysis and Experimental validation of a low-complexity enhanced orientation-

based controller for tethered energy-harvesting systems. IEEE Transactions on Control Systems Technology 2025; In Press.

Fine J, McGuire C, Williams V, Jenkins M, McDaniel H, Keele M, Bryant M, Gopalarathnam A, Vermillion C. optimal cyclic control of a structurally constrained morphing energy-harvesting kite using an experimentally validated simulation model. IEEE Transactions on Control Systems Technology 2025; 33:744–759.

Abney A, Fine J, Vermillion C. Drag-mitigating dynamic flight path design and sensitivity analysis for an ultra-long tether underwater kite. ASME Journal of Dynamic Systems, Measurement, and Control 2025; 147.

Reed J, Naik K, Abney A, Herbert D, Fine J, Vadlamannati A, Morris J, Taylor T, Muglia M, Granlund K, Bryant M, Vermillion C. Experimental validation of an iterative learning-based flight trajectory optimizer for an underwater kite. IEEE Transactions on Control Systems Technology 2024; 32:1240–1253.

Presentations

Fine J, Holbrook I, Vermillion C, Co-design for real-time adaptability: methodology and wind energy case study. Oral presentation, 4th ASME Modeling, Estimation, and Control Conference, Chicago IL, 2024.

Fine J, Vermilion C. Analysis and experimental validation of a low-complexity enhanced orientation-based controller for tethered energy harvesting systems. Oral presentation, 10th International Airborne Wind Energy Conference, Madrid, Spain, 2024.

Fine J, McGuire C, Bryant M, Vermillion C. Optimal cyclic control of a structurally constrained span-morphing underwater kite in a spatiotemporally varying flow. Oral presentation, American Control Conference, San Diego, CA, 2023.

Fine J, Reed J, Naik K, Vermillion C. Predictive control of a morphing energy-harvesting kite. Oral presentation, 6th IEEE Conference on Control Technology and Applications, Trieste, Italy, 2022.

Fine J, Reed J, Naik K, Vermillion C. Predictive control of a morphing energy-harvesting kite. Oral presentation, 6th IEEE Conference on Control Technology and Applications, Trieste, Italy, 2022.

Project Experience

Led the development of the control system for a large-scale underwater energy-harvesting system. Performed remote and on-site testing, troubleshooting, and debugging for the system. Developed and deployed end use control code for said energy-harvesting system. Created and led a series of workshops to train a team of DARPA engineers and defense contractors on a Simulink-based multibody dynamic simulation platform.

Peer Reviews

ASME Journal of Dynamic Systems. Measurements and Controls

IEEE Transactions on Control Systems Technology