Nikhar J. Abbas

Curriculum Vitae

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The windmill with its skeleton tower and creaking vanes is an object of beauty as significant in its way as the cottonwood tree, and the open tank at its foot, big enough to swim in, is a thing of joy to man and beast, no less worthy of praise than the desert spring.
- Edward Abbey

Education

2017 – Pres. (Aug) **Doctor of Philosophy**, *University of Colorado Boulder*, Mechanical Engineering, Thesis Title: *Enabling Control for Wind Turbine Design.*

2015 – 2016 (Sept – Jun) **Master of Science**, *University of California, San Diego*, Mechanical Engineering, Thesis Topic: *Small Disturbance, Long Term Voltage Stabilization on a Distribution Feeder in Kathmandu, Nepal.*

2011 – 2016 (Sept – Jun) **Bachelor of Science**, *University of California, San Diego*, Environmental Engineering.

Employment

2017 – Pres. (Aug) **Graduate Research Assistant**, *University of Colorado Boulder*, Boulder, CO, Thesis Advisor: Professor Lucy Pao.

Conducted research concerning integration of wind turbine control systems into automated wind turbine design processes. This has been done in close collaboration with the National Renewable Energy Laboratory (NREL) for the entirety of my graduate research. The largest contributions of this work include:

- Creator and lead developer of the Reference OpenSource Controller (ROSCO) – a fully automated wind turbine controller tuning and implementation framework for use by the wind energy community (1.1K+ documentation visits from 45+ countries.)
- Integration of ROSCO into the ARPA-E funded Wind Energy with Integrated Servo-control (WEIS) framework, a multi-disciplinary optimization tool for fixed and floating offshore wind turbines.
- Co-design optimization of trailing-edge flaps on low specific power rotors and floating offshore wind turbines.
- Analysis of controller influence on floating wind turbine design optimization through robust stability margin constrained controller tuning processes.

2017 – 2018 (Aug – May) **Graduate Teaching Assistant**, *University of Colorado Boulder*, Boulder, CO, MCEN 4043 - System Dynamics.

Lead teaching assistant for the primary senior-level system dynamics laboratory course taught in the Mechanical Engineering Department at CU Boulder.

- Instructed and supervised 60+ students in bi-weekly laboratory experiments focused on the fundamentals of mechanical and electrical system dynamics.
- Hosted weekly office hours
- Graded homework and exams

2016 – 2017 (Jul – Jun) **Graduate Controls Intern**, *National Renewable Energy Laboratory*, Golden, CO.

- Unknown input, EKF design for Wave Energy Converter (WEC) state estimation
- Wave excitation force forecasting via autoregressive parameter estimation
- Model predictive control to maximize power production and minimize foundation loads

2015 – 2016
Sept Jun

Graduate Research Assistant, *University of California, San Diego*, San Diego, CA, Thesis Advisor: Professor Jan Kleissl.

Research in optimiziation and control of a grid connected solar-plus-battery system in Kathmandu, Nepal to improve voltage quality for local feeder connections. The work was primarily conducted through MATLAB and OpenDSS and in collaboration with the NGO, RIDS-Nepal.

Relevant Skills

- Extensive knowledge of wind turbine control systems, especially within the context of turbine design.
- Setting up, running, and post-processing simulation data from wind turbine design load cases and related large data sets.
- Use of version control for collaborative software development (git).
- Use of large-scale High Performance Computing systems for parallel processing.
- Multi-disciplinary optimization, particularly within the OpenMDAO framework.

Programing Languages

- Python
- MATLAB/Simulink
- Modern Fortran

Wind Energy Software Expertise

- ROSCO
- OpenFAST
- WEIS/WISDEM

First-Author Journal Papers

2021 Abbas, Nikhar J., Daniel Zalkind, Lucy Pao, and Alan Wright (2021). "A Reference Open-Source Controller for Fixed and Floating Offshore Wind Turbines". In: *Wind Energy Science Discussions*, pp. 1–33. .

First-Author Conference Papers

2020 Abbas, Nikhar J. and Lucy Pao (2020). "On the Controllability of a Floating Offshore Wind Turbine". In: vol. 1452. IOP Publishing, p. 012001. .

2020 Abbas, Nikhar J., Alan Wright, and Lucy Pao (2020). "An Update to the National Renewable Energy Laboratory Baseline Wind Turbine Controller". In: 1452, p. 012002. .

2019 Abbas, Nikhar J., Daniel Zalkind, and Lucy Pao (2019). "Assessing Control of a Floating Wind Turbine Based on Harmonic Loads Analysis". In: *AIAA Scitech 2019 Forum*, p. 1802. .

2017 Abbas, Nikhar J. and Nathan Tom (2017). "Utilization of Model Predictive Control to Balance Power Absorption Against Load Accumulation". In: *The 27th International Ocean and Polar Engineering Conference*. OnePetro. .

Presentations

2020 Abbas, Nikhar J., Roland Feil, and Lucy Pao (2020). "Generic Controller Development for Distributed Aerodynamic Control Devices on Large Wind Turbine Blades". In: American Control Conference 2020.

Refereed Journal Papers

2021 Bortolotti, Pietro et al. (2021). "Land-Based Wind Turbines with Flexible Rail-Transportable Blades–Part 1: Conceptual Design and Aeroservoelastic Performance". In: *Wind Energy Science* 6.5. .

Refereed Technical Reports

2020 Allen, Christopher et al. (2020). *Definition of the UMaine VolturnUS-S Reference Platform Developed for the IEA Wind 15-Megawatt Offshore Reference Wind Turbine*. Tech. rep. National Renewable Energy Lab.(NREL), Golden, CO (United States).

2020 Gaertner, Evan et al. (2020). "Definition of the IEA 15 MW Offshore Reference Wind Turbine". In: *International Energy Agency. https://www. nrel. gov/docs/fy20osti/75698. pdf*.

Refereed Conference Papers

2021 Lenfest, Eben, Andrew Goupee, et al. (2021). "Two-DoF Model-Informed Controller Gain Tuning for Several Floating Wind Platforms". In: *The 31st International Ocean and Polar Engineering Conference*. OnePetro.

2020 Feil, Roland et al. (2020). "Distributed Aerodynamic Control using Active Trailing-Edge Flaps for Large Wind Turbines". In: *Journal of Physics: Conference Series*. Vol. 1618. 4. IOP Publishing, p. 042026.

2020 Lenfest, Eben, Andrew J Goupee, et al. (2020). "Tuning of Nacelle Feedback Gains for Floating Wind Turbine Controllers Using a Two-Dof Model". In: *International Conference on Offshore Mechanics and Arctic Engineering*. Vol. 84416. American Society of Mechanical Engineers, V009T09A063.

2020 Rinker, Jennifer et al. (2020). "Comparison of loads from HAWC2 and OpenFAST for the IEA Wind 15 MW Reference Wind Turbine". In: *Journal of Physics: Conference Series*. Vol. 1618. 5. IOP Publishing, p. 052052.

Thesis

2016 Abbas, Nikhar J. (2016). *Small Disturbance, Long Term Voltage Stabilization on a Distribution Feeder in Kathmandu, Nepal*. University of California, San Diego.

Honors and Awards

2017 Aug — Outstanding Mechanical Engineering Research Potential Fellowship

Philanthropy

2018 – Pres. Dec — **Assisted Ski Instructor**, *National Sports Center for the Disabled*, Winter Park, Colorado.

Volunteer instructor with the NSCD assisted program ski program, a program that brings disabled persons onto the ski slopes of the Winter Park Ski Resort in Colorado.

2021 – Pres. Jul — **Surplus Food Distribution**, *Denver Food Rescue*, Denver, CO.

Transport surplus food around Denver, primarily by bicycle. DFR works to collect unwanted food and distributes to community centers that then provide the food to those in need.

Hobbies and Interests

A list of activities that fill my proverbial cup:

- A general love for spending time in the outdoors – activities including but not limited to: trail running, rock climbing, bicycle riding, and skiing.
- General handy-work regarding my home, vehicle, and bicycle.
- Ultimate frisbee and soccer