

Education

- December 2021 **Ph.D. Mechanical Engineering**, *University of Colorado*, Boulder, Colorado, **3.97 GPA**
Dissertation Title: *Outer-Loop Applications of Computational Fluid Dynamics for Wind Energy Systems*
Expected graduation: December 2021. Advisors: Prof. Peter E. Hamlington and Dr. Ryan N. King
Funded by National Renewable Energy Laboratory (NREL) Alliance Partner University Program
“Uncertainty Quantification and Optimization Under Uncertainty for Wind Plant Modeling”
- 2019 **M.S. Mechanical Engineering**, *University of Colorado*, Boulder, Colorado
- 2015 **B.S. Environmental Resources Engineering**, *Humboldt State University*, Arcata, California

Research Interests

Wind energy systems engineering, computational fluid dynamics, Machine learning, uncertainty quantification, sensitivity analysis, fatigue and extreme loads estimation, optimization modeling, stochastic optimization, model calibration, multifidelity techniques, and data management.

Research Experience

- 8/2017–1/2022 **Postdoctoral Researcher**,
Department of Wind Energy and Energy Systems, Technical University of Denmark, Roskilde, Denmark
- Maintenance and development of the DTU PyWake and TOPFARM frameworks.
 - Developed stochastic gradient descent wind farm optimization framework and helped implement it in TOPFARM.
 - Implemented high-dimensional surrogate of energy systems model for uncertainty quantification and sensitivity analysis.
 - Implemented holistic uncertainty management for verification and validation of wind energy systems.
 - Detailed comparison of FLORIS and PyWake wind farm simulation codes.
 - Contributor to the WIMBY and FLOW EU projects, as well as various funding applications.
- 8/2017–1/2022 **Graduate Research Assistant**,
Turbulence and Energy Systems Laboratory, University of Colorado, Boulder, Colorado, USA
- Developed multifidelity multiobjective optimization approach for maximizing power produced and minimizing fatigue loading induced by wake steering control strategies, utilizing a LES actuator line wind plant model.
 - Collaborated with NREL systems engineering and field measurement teams to quantify realistic yaw position uncertainties for wake steering control optimization under uncertainty.
 - Worked with NREL high-fidelity modeling team to publish field sensitivity analysis approach for analyzing discrepancies between observed phenomena and computational predictions
 - Developed multilevel-multifidelity uncertainty quantification approach for RANS airfoil simulations.
- 8/2017–2022 **Graduate Research Assistant**,
Turbulence and Energy Systems Laboratory, University of Colorado, Boulder, Colorado, USA
- Developed multifidelity multiobjective optimization approach for maximizing power produced and minimizing fatigue loading induced by wake steering control strategies, utilizing a LES actuator line wind plant model.
 - Collaborated with NREL systems engineering and field measurement teams to quantify realistic yaw position uncertainties for wake steering control optimization under uncertainty.
 - Worked with NREL high-fidelity modeling team to publish field sensitivity analysis approach for analyzing discrepancies between observed phenomena and computational predictions
 - Developed multilevel-multifidelity uncertainty quantification approach for RANS airfoil simulations.
- 5/2015 – 8/2017 **Wind Energy Systems Engineering Intern**,
National Renewable Energy Laboratory, Boulder, Colorado, USA
- Supported NREL Systems engineering team research activities, including FAST sensitivity analysis, estimating extreme loads, heterogeneous turbines within wind plants, optimization under uncertainty, generator design, SCADA analysis, and active subspaces for surrogate modeling.
 - Developed pyDAKOTA software package, connecting DAKOTA with OpenMDAO.
 - Applied optimization under uncertainty to wake steering problem, examining effects of yaw position uncertainty.

5/2014– **Software Engineering Intern,**

8/2014 *National Center for Atmospheric Research*, Boulder, Colorado, USA

- Created a Python and Bash based live SQL data monitoring system to inform research aircraft technicians when atmospheric data collected is outside of the metadata range.
- Restructured metadata file: binary to XML converter, C++ application programming interface, and Python pyqt4 graphic user interface (GUI).
- Programmed pyqt4 GUIs for project managers to edit configuration files.

Professional Experience

10/2013 - **Project Manager,**

12/2015 *Humboldt State University Campus Center for Appropriate Technology*, Arcata, California, USA

- Managed groups of students creating projects, including 1,500 gallons of rainwater catchment, off-grid battery systems, energy load monitoring system, and green building course.
- Facilitated tours and demonstrations of Appropriate Technology to both large and small groups, including elementary school classes and university students, staff, and faculty.

Teaching Experience

1/2021– **Graduate Teaching Assistant**, *Turbulence (Mechanical Engineering 7221 / Aerospace Engineering*

5/2021 *6037)*, University of Colorado, Boulder, Colorado, USA

- Provided detailed feedback on student submissions.
- Summarized student performance, sometimes utilizing simple statistics and charts, for the professor's reference.

1/2015– **Tutor**, *Society of Hispanic Professional Engineers*,

12/2015 *Humboldt State University*, Arcata, California, USA

- Assisted students in understanding and completing engineering assignments.

2014 **Teaching Assistant**, *Computational Methods for Environmental Engineering II (Environmental Engineering 325)*, Humboldt State University, Arcata, California, USA

- Facilitated weekly classroom Fortran programming laboratories.
- Graded Fortran and probability theory assignments.
- Facilitated lectures and quizzes when professor was unavailable.

Publications

Book Chapter

- [1] Andrew Ning, Katherine Dykes, and **Julian Quick**. *Systems engineering and optimization of wind turbines and power plants*, volume 2, pages 235–92. Institution of Engineering and Technology, 2019

Peer-Reviewed Journal Publications

- [2] **Julian Quick**, Ryan N. King, Marc T. Henry de Frahan, Shreyas Ananthan, Michael A. Sprague, and Peter E. Hamlington. Field Sensitivity Analysis of Turbulence Model Parameters for Flow Over a Wing. *International Journal for Uncertainty Quantification*, 12(1):85–106, 2022
- [3] **Julian Quick**, Jennifer King, Ryan N. King, Peter E. Hamlington, and Katherine Dykes. Wake steering optimization under uncertainty. *Wind Energy Science*, 5(1):413–426, 2020

Papers in Preparation

- [4] **Julian Quick**, Ryan N. King, Garrett Barter, and Peter E. Hamlington. Multifidelity Multiobjective Optimization for Wake Steering Strategies. *Wind Energy Science*
- [5] Andy Clifton, Sarah Barber, Andrew Bray, Peter Enevoldsen, Jason Fields, Mike Purdue, Anna Maria Sempreviva, Lindy Williams, **Julian Quick**, Philip Totaro, Yu Ding. Grand Challenges in The Digitalisation of Wind Energy. *Wind Energy Science*

Conference Proceedings

- [6] **Julian Quick**, Peter E. Hamlington, Ryan King N., and Michael A. Sprague. Multifidelity uncertainty quantification with applications in wind turbine aerodynamics. In *AIAA Scitech 2019 Forum*, page 0542, 2019
- [7] Peter A Graf, Ryan N. King, Katherine Dykes, **Julian Quick**, Levi Kilcher, and Jennifer Rinker. Temporal coherence importance sampling for wind turbine extreme loads estimation. In *AIAA Scitech 2019 Forum*, page 1798, 2019
- [8] Ryan N. King, **Julian Quick**, Christiane Adcock, and Katherine Dykes. Active subspaces for wind plant surrogate modeling. In *2018 Wind Energy Symposium*, page 2019, 2018
- [9] Amy N Robertson, Latha Sethuraman, Jason Jonkman, and **Julian Quick**. Assessment of wind parameter sensitivity on extreme and fatigue wind turbine loads. In *2018 Wind Energy Symposium*, page 1728, 2018
- [10] Latha Sethuraman, **Julian Quick**, Katherine Dykes, and Yi Guo. Exploring optimization opportunities in four-point suspension wind turbine drivetrains through integrated design approaches. In *2018 Wind Energy Symposium*, page 1000, 2018

Publications (Continued)

Conference Proceedings (Continued)

- [11] **Julian Quick**, Jennifer Annoni, Ryan N. King, Katherine Dykes, Paul Fleming, and Andrew Ning. Optimization under uncertainty for wake steering strategies. In *Journal of physics: Conference series*, volume 854, page 012036. IOP Publishing, 2017
- [12] **Julian Quick**, Katherine Dykes, Peter Graf, and Frederik Zahle. Optimization under uncertainty of site-specific turbine configurations. In *Journal of Physics: Conference Series*, volume 753, page 062012. IOP Publishing, 2016
- [13] Peter Graf, Katherine Dykes, George Scott, Jason Fields, Monte Lunacek, **Julian Quick**, and Pierre-Elouan Rethore. Wind farm turbine type and placement optimization. In *Journal of Physics: Conference Series*, volume 753, page 062004. IOP Publishing, 2016

Conference Presentations

Conference Presentations by J. Quick

- [1] **Julian Quick**, “Optimization and Load Surrogates Using Multi-Fidelity Models” *International Energy Agency Collaborative Research Task on Wind Energy Systems Engineering Workshop: Load Surrogates and Reliability-Based Optimization for Wind Farms*, 2021
- [2] **Julian Quick**, Sarah Barber, Yu Ding, Berthold Hahn, Mike Kelly, Fiona Lüdecke, Mike Purdue, and Anna Maria Sempreviva, “Shared Semantics and Incentivizing Data Sharing” *International Energy Agency Collaborative Research Task on Wind Energy Digitalization – 3rd General Meeting*, 2021
- [3] **Julian Quick**, Ryan N. King, Peter E. Hamlington, “Multifidelity Multiobjective Optimization for Wake Steering Strategies,” *Rocky Mountain Fluid Mechanics Research Symposium*, 2021
- [4] **Julian Quick**, Ryan N. King, Peter E. Hamlington. “Multiobjective Multifidelity Optimization for Wake Steering Design”, *Society for Industrial and Applied Mathematics Conference on Computational Science and Engineering Mini-symposium 140: Multifidelity Sampling Approaches for Forward/Inverse UQ and Optimization under Uncertainty*, 2021
- [5] **Julian Quick**, Ryan N. King, Marc Henry de Frahan, Shreyas Ananthan, Michael A. Sprague, and Peter E. Hamlington. “Field sensitivity analysis for wind energy modeling”, *Bulletin of the American Physical Society*, 2020
- [6] **Julian Quick**, Peter E. Hamlington, Ryan N. King, Marc Henry de Frahan, Shreyas Ananthan, Michael Sprague, “Field Sensitivity Analysis for Wind Energy Modeling,” *Rocky Mountain Fluid Mechanics Research Symposium*, 2020
- [7] **Julian Quick**, Peter E. Hamlington, Ryan N. King, Michael Sprague, “Capturing a Blade Tip Vortex,” *Rocky Mountain Fluid Mechanics Research Symposium*, 2019

- [8] **Julian Quick**, Peter E. Hamlington, Ryan N. King, and Michael A. Sprague, 2019. “Multifidelity Uncertainty Quantification with Applications in Wind Turbine Aerodynamics”. In *AIAA Scitech 2019 Forum*
- [9] **Julian Quick**, “Optimization Under Uncertainty for Wake Steering Strategies,” *Wake Conference*, Uppsala University, Visby, Sweden, 2017
- [10] **Julian Quick**, Jennifer Annoni, Ryan N. King, Paul Fleming, Andrew Ning, and Katherine Dykes, “Optimization Under Uncertainty for Wind Power Plant Wake Steering Strategies,” *Rocky Mountain Fluid Mechanics Research Symposium*, 2017
- [11] **Julian Quick**, Jennifer Annoni, Ryan N. King, Katherine Dykes, Paul Fleming, Andrew Ning. “Optimization Under Uncertainty for Wake Steering Strategies,” *Wind Energy Science Conference*, 2017

Presentations with Collaboration from J. Quick

- [12] Rob Hammond, Alex Koltsidopoulos, **Julian Quick**, “Data Science Quick Start Tutorial and Hackathon” *International Energy Agency Collaborative Research Task on Wind Energy Digitalization – 3rd General Meeting*, 2021

Presentations with Collaboration from J. Quick (Continued)

- [13] Peter Graf, Ryan N. King, Katherine Dykes, **Julian Quick**, Levi Kilcher, Jennifer Rinker, “Temporal Coherence Importance Sampling for Wind Turbine Extreme Loads Estimation”, *AIAA Scitech 2019 Forum*
- [14] Ryan N. King, **Julian Quick**, Christiane Adcock, Katherine Dykes, “Active Subspaces for Wind Plant Surrogate Modeling”, *AIAA Wind Energy Symposium*, 2018
- [15] Latha Sethuraman, **Julian Quick**, Katherine Dykes, Yi Guo, “Exploring Optimization Opportunities in Four-Point Suspension Wind Turbine Drivetrains through Integrated Design Approaches”, *AIAA Wind Energy Symposium*, 2018
- [16] Katherine L. Dykes, Rick R. Damiani, Peter A. Graf, George N. Scott, Ryan N. King, Yi Guo, **Julian Quick**, Latha Sethuraman, Paul S Veers, and Andrew Ning. Wind turbine optimization with wisdom. Technical report, National Renewable Energy Laboratory (NREL), Golden, CO, 2018

Professional Service

Lectures and Seminars

- 9/2021 **Invited Seminar**, *Outer-Loop Applications of Computational Fluid Dynamics for Wind Energy Systems*, National Renewable Energy Laboratory, Boulder, Colorado
- 4/2021 **Invited Lecture**, *Wind Energy Overview*, Energy for a Sustainable Future (Environmental Science 15), Cabrillo College, Aptos, California
- 4/2019 **Public Lecture**, *What’s Blowing in the Wind? Wind Turbine Modeling and Wind Farm Optimization*, Pint of Science, Diebolt Brewing Company, Denver, Colorado

Organizations

- 5/2021–**Founding Member**, *Committee for Equity in Mechanical Engineering (CEME)*, Paul M. Rady Present Department of Mechanical Engineering, University of Colorado, Boulder, Colorado
 - Spearheaded effort to mitigate the potential of implicit bias influencing preliminary exam results.
- 8/2020–**Contributing Researcher**, *IEA Wind Task 43*, Data Science, Data Standards, and Data Sharing Present
 - Collaborating with international team to develop recommendations for the future of wind energy data.
- 8/2014–**President**, *Renewable Energy Student Union*, Humboldt State University, Arcata, California
- 8/2015
 - Led group of approximately 15 students: micro-hydro power demonstration, DOE Hydrogen fueling station and NREL net-zero energy housing design competitions, bicycle blender, and off-grid facility energy audit.

Mentorship

- 5/2020– **Mentor**, *Fluid Dynamics Preliminary Exam Preparation*, Paul M. Rady Department of Mechanical Engineering, University of Colorado, Boulder, Colorado
- Tutored and quizzed students in advanced fluid mechanics topics.
 - Encouraged students to perform thought experiments for deeper understandings of fluid mechanics.
- 2/2016– **Peer Mentor**, *Women of Wind Energy*
- 8/2017 • Regularly participated in meetings and book club.

Peer Review Service

- 4/2017– *Wind Energy, Sustainable Energy Technologies and Assessments, Journal of Wind Engineering and Present Industrial Aerodynamics, Renewable Energy*

Open-Source Software Contributions

AeroelasticSE, CommonSE, DriveSE, GeneratorSE, JacketSE, Nalu, Nalu-Wind, OpenMDAO-1, Plant_CostsSE, Plant_FinanceSE, python-windrose, RotorSE, TowerSE, Turbine_CostsSE, WindSE, WISDEM, and xgboost.