Emmanuel Branlard

Senior Researcher at NREL
PhD in aerodynamics & aeroelasticity
MS in aerospace & MS in wind energy

✉ Boulder, CO, USA
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⊙ ebranlard ⌉

Immersed in the field of wind energy since 2008, with a strong drive for theory and analytical methods. Working on low-to-mid fidelity models and applying multi-physics approaches in topics such as system dynamics, controls, aerodynamics, and structural dynamics.

Education

2012-2015 - **PhD at DTU** (Technical University of Denmark), Aero-Elastic Design section. Project:
(June 2015)   "Wind turbines aerodynamics and aeroelasticity using vortex based methods", under Mac Gaunaa supervision. Developed analytical models for rotor aerodynamics. Implemented a vortex-based aerodynamic code coupled to a structural solver (Hawc2).
Roskilde, Denmark

2010-2011 - **MS in Wind Energy at DTU** - Majors on mechanics and fluid dynamics. Focus on:
(Nov. 2011)   aero-elasticity, control, wind ressource and wave dynamics.   *Lyngby, Denmark*

2006-2010 - **MS in Aerospace at SupAero** - Advanced maths and physics applied to aerospace
(July 2010)   and mechanical engineering. French Graduate School of Aerospace Engineering (ISAE-SupAero).
Toulouse, France

(June 2006)   **Passed the competitive entrance exam to French elite "Grandes Ecoles".**

2004-2006 - **Intensive undergraduate studies** in a national preparatory program. Fundamental studies in maths, physics and computer science.   *Lycée du Parc - Lyon, France*

Work Experiences

2018 - **Senior Researcher** at **NREL** (National Renewable Energy Laboratory) Research and
(current)   development of multi-physics (hydro-servo-aero-elasticity) wind turbine models, with applications in: blade aerodynamic, blade design, aero-elastic stability analyses, digital-twins, floating turbines, wind-farm flows. Contributes to the development of NREL tools, such as OpenFAST and FAST.Farm.   *Boulder, CO, USA*

2016-2018 - **Loads and Metocean Engineer** at **DONG Energy** (now Ørsted). Main developer of
(2½ years)   in-house aero-elastic tool, implementation of aerodynamic and structural models. Post-processing of measurement data. Wind and Metocean assessments. Full load case simulations and preliminary load estimations. Tool developments: joint-probability, rain flow count, wind-farm induction.   *Gentofte, Denmark*

2015 - **Postdoc** at **DTU**. Wind turbine aero-elasticity. Projects: wind farm optimization,
(9 months)   induction zone, Hawc2 development, rain erosion, airfoil flaps.   *Roskilde, Denmark*

2012 - **Research assistant** position at **DTU**. Fundamental wind turbine aerodynamics: ana-
(4 months)   lytical vortex solutions, numerical vortex methods and wind turbines tip-losses.
Roskilde, Denmark

2011 - **Internship and Master thesis** at **Siemens Wind Power** on wind turbine tip-loss
(6 months)   corrections. Review, implementation and investigation of new tip-loss models. Implementation of a free wake vortex code. Analysis of CFD data.   *Boulder, CO, USA*

2010 (9 months)	**Student job** at **Risø** under J. Mann supervision. Research projects related to lidars and turbulence: lidar model and simulation, systematic error, relation between spectra and wind speed PDF. Remote sensing. *Roskilde, Denmark*
2009 (5 months)	**Internship and Master thesis** at **Fermilab** linear particle accelerator, under H. Edwards supervision. Particle physics and relativity. Development of a 3D space charge algorithm for particle tracking in accelerators, with application to emittance exchange. *Chicago, IL, USA*
2008-2009 (6 months)	**Master thesis** at **ECN** (Energy Center of the Netherlands) under P. Eecen supervision. Analyses of wind farm and meteorological data. Project: Gusts propagation through wind farms and resulting loading on wind turbines - Followed a course on blade design by H. Snel. *Petten, The Netherlands*

Field Work

2010 (3 weeks)	Field work related to the implementation of remote renewable energy solutions in Greenland. Maintenance of small wind turbines. Maintenance, installation and instrumentation of different meteorological mast with their data aquisition systems. Setup of a standalone grid using solar panels and a vertical axis wind turbine. *Sisimiut, Greenland*

Distinctions

Postdoc -	Received a 2 million DKK ($200k) grant from the Danish Council for Independent Research for a project on the design and optimization of 20MW wind turbines (2016)
PhD Award -	Received the Excellent Young Wind Doctor Award from the European Academy of Wind Energy (2015).
PhD Grant -	Received the danish "Elite-researcher"(EliteForsk) travel scholarships of 300k DKK ($45k) for talented PhD students from the minister for Education and Research (2014).
Education -	Received the French Scientific Baccalaureat with high honors (2004).
Music -	Received the 1st prize in Xylophone and Special committee prize (2003) - *Young Musician National Exam - France*

Project management and fundings

Legend: PI†: Principal Investigator. Project proposal written and managed by myself.

PW&AM*: I helped in the proposal writing and I am an active member of the project.

Year	Budget	Role & Project
2022 (3 y)	$2.5M	PW&AM*. Multiyear, multilab project awarded as part of an open call from the Department of Energy (DOE), for a project on: *Distributed Wind Aeroelastic Modeling.* The partner is Sandial National Laboratory. The funding for NREL is $1.5M.
2022 (1 y)	$150k	PW&AM*. Subproject awarded as part of an open call from DOE, for a project on: *NoVo rotor, the no-vortex rotor for improved aerodynamics performances.* The full project has a budget of $3M.
2022 (9 mos.)	$55k	PI†. NREL seed funding for a project on: *Validation Study of a Vertical-Axis Wind Turbine Prototype.*
2021 (9 mos.)	$63k	PI†. Subcontractor on a ARPA-E project developed with the industrial partner XFlow Energy. *Development of an Aero-elastic Coupling Between AeroDyn and OWENS.*

2021 (1.5 y)	$300k	PW&AM*. Project granted from the National Offshore Wind Research & Development Consortium (NOWRDC), as a partnership between NREL and TUFTs university (lead). The NREL budjet is $100k. *Optimal Sensor Placement for Physics-Based Digital Twins.*
2020 (1.5y)	$200k	PI†. Grant received from DOE as part of the Technology Commericalization Fund, for the project: *Offshore wind turbine digital twin for the prediction of component failures.*
2020 (7 mos.)	$60k	PI†. NREL seed funding for a project on: *Mid-fidelity model development: OLAF Driver for VAWTs.*
2019 (2.5y)	$200k	PI†. External funding provided by the industrial partner Vestas Wind Systems, for a project on *Mid-fidelity model development of VTS.Farm.*
2015 (2y)	$200k	PI†. Research grant received from the Danish Council for Independent Research for a project on *Design and optimization of 20MW wind turbines.*

Professional stays (not conferences)

Stays - **DTU** (2019, Denmark, 2 d.), **Vestas** (2019, Denmark, 2 d.), **TUDelft** (2014, The Netherlands, 2 w.), **NTNU** (2014, Norway, 1 w.), **ULouvain** (2014, Belgium, 1 w.), **PUC Rio** (2014, Brasil, 3 d.), **NTUA** (2013, Greece, 2 mos.), **UVic** (2013, Canada, 1 mo.), **Fermilab** (2009, USA, 7 mos.), **ECN** (2008, The Netherlands, 6 mos.), **ONERA** (2014, France, 1 d.)

Invitations **EPFL** (2015, Switzerland, 2 d.)

Teaching experiences

2022 -	Directed a one day **seminar** on *Practical usage of OpenFAST* as a side-event of the NAWEA conference. *Delaware, USA*
2015 -	**Invited lecturer** in the research group of Fernando Porte-Agel at the EPFL on *Vorticity-based methods for wind turbine aerodynamics.* *Lausanne, Switzerland*
2015 -	**Guest lecturer** for the 11th PhD Seminar (3 days) organized by the European Wind Energy Academy on *Aeroelasticity using vortex-based methods.* *Oldenburg, Germany*
2015 -	Attended a one week **teaching and learning course** held by the learning lab of DTU. *Roskilde, Denmark*
2013 - (1 month)	**Teaching assistant** position at **DTU** for the wind energy master course *Planning and Development of Wind Farms.* *Lyngby, Denmark*
2012 -	**Guest lecturer** for the graduate course by Henrik Bredmose at DTU, on *Offshore wind energy.* *Roskilde, Denmark*

Other teaching experiences

2002 - (2 years)	**Mime teacher** at municipal community for kids aged between 8 and 10. *Dallet, France*

Students advised

2022 (current)	PostDoc	Mayank Chetan's mentor for a postdoc project on *Aeroelastic stability of wind turbines.* *NREL, USA*
2021 (current)	PhD	Cheng Liu's co-supervisor for a PhD project on *Vortex particle methods for wind energy.* *UMass, USA*
2021 (current)	PhD	Nasim Partovi's co-supervisor for a PhD project on *Digital twinning and inverse modeling approaches for wind energy.* *TUFTs, USA*

2020 (6 months)	MS	Benjamin Anderson's mentor for a research project on *Investigation of the nacelle blockage effect for a downwind turbine.* DOI:10.1088/1742-6596/1618/6/062062 ☒	*NREL, USA*
2014 (6 months)	MS	Philippe Mercier's supervisor for a master's thesis on *Tree-code algorithm for large scale vortex method simulation.*, External Link ☒	*DTU, Denmark*
2022 (3 months)	BS	Natalia Nieto-Wire's supervisor for a Science Undergraduate Laboratory Internship (SULI) project on *Wind Turbine Aeroelastic Response Predictions for Turbines with Increasingly Flexible Blades under Turbulent Wind Speed.* . Natalia studied at The City College of New York.	*NREL, USA*
2021 (4 months)	BS	Sarah LaVallie's co-supervisor. Sarah visited NREL as part of the Graduate Education for Minority Students (GEM) program. Her project was on *Influence of power coefficient on fatigue loads.* Sarah studied at the North Dakota State University, ND, External Link ☒	*NREL, USA*
2021 (3 months)	BS	Kelly Clevenson's supervisor for a SULI project on *Linearization of an aeroelastic model of an airfoil section.* Kelly studied at UMass, MA.	*NREL, USA*
2020 (3 months)	BS	Kelly Clevenson's supervisor for a SULI project on *Augmented Kalman Filter to estimate monopile and tower loads on an offshore wind turbine.* Kelly studied at UMass, MA.	*NREL, USA*
2019 (3 months)	BS	Dylan Giardina's supervisor for a SULI project on *Turbine load estimation using Kalman filtering.* Dylan studied at the Colorado State University, in Fort Collins, CO.	*NREL, USA*

Textbooks

(2023)	-	Manwell, J., McGowan, J., **Branlard, E.**. 'Wind Energy Explained, Third edition'. *Wiley*, (Under contract, publication expected in 2023. Contributor to the following chapters: Aerodynamics, Control, Dynamics, Floating wind turbines.)
2017	-	**Branlard, E.**. 'Wind Turbine Aerodynamics and Vorticity-based methods: Fundamentals and recent applications'. *Springer International Publishing*, DOI:10.1007/978-3-319-55164-7 ☒ ISBN: 978-3-319-55163-0

Journal publications (preprints)

(2023)	34.	Partovi-Mehr, N., **Branlard, E.**, Song, M., Moaveni, B, Hines, E.. (2023) 'Modeling of an Offshore Wind Turbine and Sensitivity Analysis of its Dynamic Properties to Operational and Environmental Conditions'. *SSRN*, DOI:10.2139/ssrn.4312852 ☒
	33.	Boorsma, K., **Branlard, E.**, et al. (2023) 'Progress in validation of rotor aerodynamic codes using field data'. *Wind Energy Science*, DOI:10.5194/wes-2022-51 ☒

Journal publications

2023	32.	Bergua, R., **Branlard, E.**, et al. (2023) 'OC6 Project Phase III: Validation of the Aerodynamic Loading on a Wind Turbine Rotor Undergoing Large Motion Caused by a Floating Support Structure'. *Wind Energy Science*, DOI:10.5194/wes-2022-74 ☒
	31.	Gaunaa, M., Troldborg, N., **Branlard, E.**. (2023) 'A simple vortex model applied to an idealized rotor in sheared inflow'. *Wind Energy Science*, DOI:10.5194/wes-2022-94 ☒
	30.	Shaler, K., Anderson, B., Martinez-Tossas, L., **Branlard, E.**, Johnson, N.. (2023) 'Comparison of Free Vortex Wake and BEM Structural Results Against Large Eddy Simulations Results for Highly Flexible Turbines Under Challenging Inflow Conditions'. *Wind Energy Science*, DOI:10.5194/wes-2021-130 ☒

2022 29. **Branlard, E.**, Geisler, J.. (2022) 'A symbolic framework to obtain mid-fidelity models of flexible multibody systems with application to horizontal-axis wind turbines'. *Wind Energy Science*, DOI:10.5194/wes-7-2351-2022 🗗

28. **Branlard, E.**, Martinez-Tossas, L., Jonkman, J.. (2022) 'A time-varying formulation of the curled wake model within the FAST.Farm framework'. *Wind Energy*, DOI:10.1002/we.2785 🗗

27. **Branlard, E.**, Brownstein, I., Strom, B., Jonkman, J., Dana, S., Baring-Gould, E.. (2022) 'A multipurpose lifting-line flow solver for arbitrary wind energy concepts'. *Wind Energy Science*, 7, p455-467, DOI:10.5194/wes-7-455-2022 🗗

26. **Branlard, E.**, Jonkman, B., Pirrung, G., Dixon, K., Jonkman, J.. (2022) 'Dynamic inflow and unsteady aerodynamics models for modal and stability analyses in OpenFAST'. *Journal of Physics: Conference series*, 2265, DOI:10.1088/1742-6596/2265/3/032044 🗗

25. J. Jonkman, **Branlard, E.**, J. Jasa. (2022) 'Influence of wind turbine design parameters on linearized physics-based models in OpenFAST'. *Wind Energy Science*, 7, p559-571, DOI:10.5194/wes-7-559-2022 🗗

24. H. Asmuth, G. P. Navarro Diaz, H. A. Madsen, **Branlard, E.**, A. R. Meyer Forsting, K. Nilsson, J. Jonkman, S. Ivanell. (2022) 'Wind turbine response in waked inflow: A modelling benchmark against full-scale measurements'. *Renewable Energy*, 191, p868-887, DOI:10.1016/j.renene.2022.04.047 🗗

2021 23. L. A Martinez-Tossas, **Branlard, E.**, K. Shaler, G. Vijayakumar, S. Ananthan, P. Sakievich, J. Jonkman. (2021) 'Numerical investigation of wind turbine wakes under high thrust coefficient'. *Wind Energy*, 25, p605-617, DOI:10.1002/we.2688 🗗

22. Meyer Forsting, A., Rathmann, O.S., van der Laan, M.P., Troldborg, N., Gribbne, B., Hawkes, G., **Branlard, E.**. (2021) 'Verification of induction zone models for wind farm annual energy production estimation '. *Journal of Physics: Conference series*, 1934, p012023, DOI:10.1088/1742-6596/1934/1/012023 🗗

2020 21. **Branlard, E.**, Meyer Forsting, A.. (2020) 'Assessing the blockage effect of wind turbines and wind farms using an analytical vortex model'. *Wind Energy*, 23, p2068-2086, DOI:10.1002/we.2546 🗗

20. **Branlard, E.**, E. Quon, A. Meyer Forsting, J. King, P. Moriarty. (2020) 'Wind farm blockage effects: comparison of different engineering models'. *Journal of Physics: Conference series*, 1618, p062036, DOI:10.1088/1742-6596/1618/6/062036 🗗

19. **Branlard, E.**, Giardina, D., Brown, C.S.D. . (2020) 'Augmented Kalman filter with a reduced mechanical model to estimate tower loads on a land-based wind turbine: a step towards digital-twin simulations'. *Wind Energy Science*, 5, p1155-1167, DOI:10.5194/wes-5-1155-2020 🗗

18. **Branlard, E.**, Jonkman, J., Dana, S., Doubrawa, P.. (2020) 'A digital twin based on OpenFAST linearizations for real-time load and fatigue estimation of land-based turbines'. *Journal of Physics: Conference series*, 1618, p022030, DOI:10.1088/1742-6596/1618/2/022030 🗗

17. Anderson, B., **Branlard, E.**, Vijayakumar, G., Johnson, N.. (2020) 'Investigation of the nacelle blockage effect for a downwind turbine'. *Journal of Physics: Conference series*, 1618, p062062, DOI:10.1088/1742-6596/1618/6/062062 🗗

16. Doubrawa, P., **Branlard, E.**, et al. (2020) 'Multimodel validation of single wakes in neutral and stratified atmospheric conditions'. *Wind Energy*, 23, p2027-2055, DOI:10.1002/we.2543 🗗

2019   15. **Branlard, E.**. (2019) 'Flexible multibody dynamics using joint coordinates and the Rayleigh-Ritz approximation: The general framework behind and beyond Flex'. *Wind Energy*, 22, p877-893, DOI:10.1002/we.2327 ☑

14. **Branlard, E.**, Shields, M., Anderson, B., Damiani, R., Wendt, F., Jonkman, J., Musial, W.. (2019) 'Superelement reduction of substructures for sequential load calculations in OpenFAST'. *Journal of Physics: Conference series*, 1452, p012033, DOI:10.1088/1742-6596/1452/1/012033 ☑

13. G. Vijayakumar, S. Yellapantula, **Branlard, E.**, S. Ananthan. (2019) 'Enhancement of Unsteady and 3D Aerodynamics Models using Machine Learning'. *Journal of Physics: Conference series*, 1452, p012065, DOI:10.1088/1742-6596/1452/1/012065 ☑

12. Martinez-Tossas, L., **Branlard, E.**. (2019) 'The curled wake model: equivalence of shed vorticity models'. *Journal of Physics: Conference series*, 1452, p012069, DOI:10.1088/1742-6596/1452/1/012069 ☑

11. Shaler, K., **Branlard, E.**, Platt, A., Jonkman, J.. (2019) 'Preliminary Introduction of a Free Vortex Wake Method Into OpenFAST'. *Journal of Physics: Conference series*, 1452, p012064, DOI:10.1088/1742-6596/1452/1/012064 ☑

10. Doubrawa, P., Debnath, M., Moriarty, P., **Branlard, E.**, Herges, T., Maniaci, D., Naughton, B.. (2019) 'Benchmarks for Model Validation based on LiDAR Wake Measurements'. *Journal of Physics: Conference series*, 1256, p012024, DOI:10.1088/1742-6596/1256/1/012024 ☑

2016   9. **Branlard, E.**, Gaunaa, M., Mercier, P., Voutsinas, S.. (2016) 'Impact of a wind turbine on turbulence: un-freezing turbulence by means of a simple vortex particle approach'. *Wind Engineering and Industrial Aerodynamics*, 151, p37-47, DOI:10.1016/j.jweia.2016.01.002 ☑

2015   8. **Branlard, E.**, Papadakis, G., Gaunaa, M., Winckelmans, G., Larsen, T.J.. (2015) 'Aeroelastic large eddy simulations using vortex methods: unfrozen turbulent and sheared inflow'. *Journal of Physics: Conference series*, 625, p012019, DOI:10.1088/1742-6596/625/1/012019 ☑

7. **Branlard, E.**, M. Gaunaa. (2015) 'Superposition of vortex cylinders for steady and unsteady simulation of rotors of finite tip-speed ratio'. 19, p1307-1323, *Wind Energy*, DOI:10.1002/we.1899 ☑

6. **Branlard, E.**, Gaunaa, M.. (2015) 'Cylindrical vortex wake model: skewed cylinder, application to yawed or tilted rotors'. *Wind Energy*, 19, p345-358, DOI:10.1002/we.1838 ☑

2014   5. **Branlard, E.**, M. Gaunaa. (2014) 'Cylindrical vortex wake model: right cylinder'. *Wind Energy*, 18, p1973-1987, DOI:10.1002/we.1800 ☑

4. **Branlard, E.**, Gaunaa, M.. (2014) 'Development of new tip-loss corrections based on vortex theory and vortex methods'. *Journal of Physics: Conference series*, 555, p012012, DOI:10.1088/1742-6596/555/1/012012 ☑

3. **Branlard, E.**, Gaunaa, M., Machefaux, E.. (2014) 'Investigation of a new model accounting for rotors of finite tip-speed ratio in yaw or tilt'. *Journal of Physics: Conference series*, 524, p012124, DOI:10.1088/1742-6596/524/1/012124 ☑

2013   2. **Branlard, E.**, Pedersen, A., Mann, J., Angelou, N., Fischer, A., Mikkelsen, T., Harris, M., Slinger, C., Montes, B.. 'Retrieving wind statistics from average spectrum of continuous-wave lidar'. (2013) *Atmospheric Measurement Techniques*, 6, p1943-1977, DOI:10.5194/amt-6-1673-2013 ☑

2012	1.	**Branlard, E.**, Dixon, K., Gaunaa, M.. (2012) 'Vortex methods to answer the need for improved understanding and modelling of tip-loss factors'. *IET Renewable Power Generation*, DOI:10.1049/iet-rpg.2012.0283 ☍

Conferences publications

2022	6.	Partovi-Mehr, N., **Branlard, E.**, Bajric, A., Liberatore, S., Hines, E., Moaveni, B.. (2022) 'Sensitivity of Modal Parameters of an Offshore Wind Turbine to Operational and Environmental Factors: A Numerical Study'. *40th International Modal Analysis Conference*,
2019	5.	Jonkman, J., Damiani, R., **Branlard, E.**, Hall, M., Robertson, A., Hayman, G.. (2019) 'Substructure flexibility and member-level load capabilities for floating offshore wind turbines in OpenFAST'. *Proceedings of ASME 2019 2nd IOWTC Conference*, DOI:10.1115/IOWTC2019-7566 ☍
2015	4.	**Branlard, E.**, Troldborg, N., Gaunaa, M.. (2015) 'A vortex based BEM-like algorithm accounting for wake rotation'. *Proceedings of EWEA Conference*,
	3.	**Branlard, E.**, Meyer, A.R., Gaunaa, M.. (2015) 'Using a cylindrical vortex model to assess the induction zone in front of aligned and yawed rotors'. *Proceedings of EWEA Conference*,
2014	2.	**Branlard, E.**, M. Gaunaa, E. Machefaux, H. Brandenborg Sørensen, N. Troldborg. (2014) 'Validation of vortex code viscous models using lidar wake measurements and CFD'. *Proceedings of EWEA Conference*,
2012	1.	**Branlard, E.**, Dixon, K. Gaunaa, M.. (2012) 'An improved tip-loss correction based on vortex code results'. *Proceedings of EWEA Conference*,

Monographs - Theses

2015	-	**Branlard, E.**. 'Analysis of wind turbine aerodynamics and aeroelasticity using vortex based methods'. Risø-DTU (PhD Thesis). ISBN: 978-87-93278-44-8
2011	-	**Branlard, E.**. 'Wind-turbine tip-loss corrections. Review, implementation and investigation of new models'. Risø-DTU (Master's Thesis).
2009	-	**Branlard, E.**. 'On the implementation of a 3D space charge algorithm to understand and further study the physics of linear accelerators'. Fermilab-SupAero (Master's Thesis).
	-	**Branlard, E.**. 'On the statistics of gusts and their propagation through a row of wind turbines'. ECN-SupAero (Master's Thesis), ECN-Wind-Memo-09-005.

Monographs - Reports

2020	-	Shaler, K., **Branlard, E.**, Platt, A.. 'OLAF User's Guide and Theory Manual'. NREL/TP-5000-75959
	-	Jonkman, J., **Branlard, E.**, Hall, M., Hayman, G., Platt, A., Robertson, A.. 'Implementation of Substructure Flexibility and Member-Level Load Capabilities for Floating Offshore Wind Turbines in OpenFAST'. *NREL/TP-5000-76822*,
	-	Bortolotti, P., **Branlard, E.**, Platt, A., Moriarty, P., Sucameli, C., Botasso, C.. 'Aeroacoustics Noise Model of OpenFAST'. *NREL/TP-5000-75731*,
2015	-	**Branlard, E.**. 'Vortex theory and vortex methods for wind energy'. Annex of PhD Thesis, Risø-DTU
2010	-	**Branlard, E.**. 'Wind power in arctic conditions: The experience of Greenland'. Risø-DTU-Artek.

2008	- Eecen, P., **Branlard, E.**. 'The OWEZ Meteorological Mast; Analysis of mast-top displacements'. ECN-M–08-067.

⚙ Opensource projects

Legend:	*M*: Main author and developer. *C*: Contributor.

Domain	Repository, Role & Description
ebranlard⮺	- pyDatView⮺*M* (69★) A crossplatform GUI to plot tabulated data or pandas dataframes.
	- welib⮺*M* (33★) Wind energy library, python and matlab tools for wind turbines analyses.
	- matlab2python⮺*M* (161★) Simple Matlab to Python converter.
openfast⮺	- openfast⮺*C* (445★) OpenFAST turbine and wind farm simulation codes.
	- python-toolbox⮺*M* (47★) Collection of Python tools developed for use with OpenFAST.
	- matlab-toolbox⮺*C* (35★) Collection of Matlab tools developed for use with OpenFAST.

Recent services

Session chair	IMECE 2022, APS 2022
Journal reviews (2019-2022)	Wind Energy Science (9), Wind Energy (1), Energies (1), Renewable and Sustainable Energy (1), SIAM Journal on Applied Mathematics (1)
Conference reviews (2019-2022)	IMECE 2022 (6), Torque 2022 (2), AIAA Scitech 2022 (2), AIAA Scitech 2020 (4), AIAA Scitech 2019 (3), Wake Conference 2019 (1)
External reviews (2019-2022)	NREL competitiveness rewards (2), DOE Small Business Innovation Research (5), NREL reports (3)
International tasks	IEA Wind Task 47 (2022-current, lead several subtasks), IEA Wind Task 29 (2019-2022, co-lead several subtasks), OC6 (2020-2021)
NREL groups	member of the LGBTQIA+ employer resource group since 2022, member of the Global employer resource group since 2020, memeber of the DEI reading group of NREL since 2022.