Michael A. Sprague

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OVERVIEW

Dr. Michael Sprague is a Chief Wind Computational Scientist in the National Wind Technology Center at the National Renewable Energy Laboratory (NREL). His expertise is in computational mechanics (fluids and structures) and high-performance computing (HPC). Beyond wind energy, his research includes biomass transport and conversion and batteries. His biggest impact at NREL has been as Principle Investigator for projects in high-fidelity modeling and HPC. He was PI for the ExaWind subproject of the U.S. Department of Energy (DOE) Exascale Computing Project, which ran from 2016 to 2024, while he was also the PI for the High-Fidelity Modeling project under the Wind Energy Technologies Office (WETO). Those projects involved four national laboratories, four universities, over forty researchers, and saw tens of millions in investment. He became Director of the FLOWMAS Energy Earthshot Research Center in 2024, which involved four national labs and three universities. He was program chair for the 2015 U.S. Department of Energy "Turbulent Flow Simulation at the Exascale: Opportunities and Challenges Workshop." Before coming to NREL in 2010, Dr. Sprague spent five years as assistant professor and founding faculty in applied mathematics at the University of California, Merced, where he was the lead in developing a new graduate program in applied mathematics. He graduated with a PhD in Mechanical Engineering from the University of Colorado at Boulder and a BS from the University of Wisconsin-Madison.

EDUCATION

University of Colorado at Boulder
PhD, Mechanical Engineering, 2002
Thesis: *Advanced Computational Techniques for the Analysis of 3-D Fluid-Structure Interaction with Cavitation*

MS, Mechanical Engineering, 1999
Thesis: *Advances in Computational Methods for Fluid-Structure-Interaction Problems*

University of Wisconsin–Madison
BS (with distinction), Mechanical Engineering, 1997
Thesis: *The Vibration of Perforated Hemispherical Shells*

WORK & RESEARCH EXPERIENCE

Chief Computational Scientist, National Wind Technology Center, National Renewable Energy Laboratory, 2021 –

Distinguished Member of Research Staff, Since 2021

Principal Scientist, National Wind Technology Center, National Renewable Energy Laboratory, 2018 – 2021

Acting Group Manager, Wind Energy Science, 2/2020 – 9/2021

Senior Scientist, National Wind Technology Center, National Renewable Energy Laboratory, 2016 – 2018

Senior Scientist, Computational Science Center, National Renewable Energy Laboratory, 2010 – 2016

Assistant Professor and Founding Faculty Member, Applied Mathematics, School of Natural Sciences, Univ. of California, Merced 2005–2010

Expert Witness, for Dreyer, Babich, Buccola & Callaham, Attorneys at Law, 2008

Maître de Conférences Invité (Visiting Assistant Professor), EGIM, Laboratoire de Modélisation en Mécanique à Marseille, France, 2005, 2007

Research Associate, Applied Mathematics, Univ. of Colorado at Boulder, 2003–2005

Visiting Scientist, CNRS, Laboratoire de Modélisation en Mécanique à Marseille, France, 2004

Research Assistant, Mechanical Engineering, Univ. of Colorado at Boulder, 1997 - 2002

Visiting Graduate Student, University of Canterbury, Christchurch, New Zealand, 2001

Research Assistant, Center for X-ray Lithography, UW–Madison, 1996 - 1997

Research Assistant, US Department of Energy, Los Alamos National Laboratory, NM, 1996

Lab Assistant, ME Computational Mechanics Laboratory, UW–Madison, 1996

Student Intern, Milwaukee Electric Tool Corporation, Brookfield, Wisconsin, 1995, 1996

PROFESSIONAL ACTIVITIES

Associate Editor, *Journal of Solar Energy Engineering - Including Wind Energy and Building Energy Conservation*, Sept. 2020 –

Program Committee Member, Research Posters, Supercomputing 2022 (SC22)

Session co-lead, US DOE AI for Science Townhall, Oak Ridge National Laboratory, 20-21 August 2019

Program Committee Member, Technical Papers Area, Applications Track, Supercomputing 2018 (SC18)

Program Committee Member, 31st IEEE International Parallel & Distributed Processing Symposium, 2017

Program Chair, DOE ASCR Workshop on Turbulent Flow Simulation at the Exascale: Opportunities and Challenges, Washington, DC, 4-5 August 2015

Program Chair, DOE A2e High Fidelity Modeling ModSim Planning Meeting, 27-28 January 2015, Denver, CO

PUBLICATIONS

Refereed Journal Publications (* corresponding author)

- Min, M., et al., Modeling turbulence in the stable atmospheric boundary layer with spectral element and finite volume methods. In preparation.
- Bidadi, S., G. Vijayakumar, B. Lee, and **M. Sprague**, Freestream turbulence effects on unsteady wind turbine loads and wakes: An IDDES hybrid RANS/LES study. Submitted to *Renewable Energy*.
- Lee, B., Vijayakumar, G., **Sprague, M.**, Assessment and improvement of the SST-Gamma transition model in an unstructured-grid flow solver. Submitted to *AIAA Journal of Aircraft*; under revision.

J49 Cheung, L. et al., Modeling the effects of active wake mixing on wake behavior through large-scale coherent structures. Accepted for publication in *Wind Energy Science*.

J48 Griffin, K.P., Vijayakumar, G., Sharma, A., **Sprague, M.A.**, 2025, Improved pressure-gradient sensor for the prediction of separation onset in RANS models. *Journal of Turbulence*, 1-88, DOI: 10.1080/14685248.2025.2468224.

J47 Kuhn, M.B., Henry de Frahan, M.T., Mohan, P., Deskos, T., Churchfield, M., Cheung, L., Sharma, A., *et al.*, 2025, AMR-Wind: A performance-portable, high-fidelity flow solver for wind farm simulations. *Wind Energy*, **28**, e70010, DOI: 10.1002/we.70010.

J46 Bidadi, S., G. Vijayakumar, G. Deskos, and **M. Sprague**, 2024, Three-dimensional aerodynamics and vortex-shedding characteristics of wind turbine airfoils over 360-Degree Angles of Attack. *Energies*, **17**, 4328, DOI: 10.3390/en17174328.

J45 Sun, M., and M. Brazell and A. Tomboulides and M. Churchfield and P. Fischer and **M. Sprague**, 2024, Towards exascale for wind energy simulations *The International Journal of High Performance Computing Applications*, **38**, 337–355. DOI: 10.1177/10943420241252511.

J44 Sharma, A., M.J. Brazell, M.J., G. Vijayakumar, S. Ananthan, L. Cheung, N. deVelder, M.T. Henry de Frahan, N. Matula, P. Mullowney, J. Rood, P. Sakievich, A. Almgren, P.S. Crozier, **M.A. Sprague**, 2023, ExaWind: Open-source CFD for hybrid-RANS/LES geometry-resolved wind turbine simulations in atmospheric flows. *Wind Energy*, DOI: 10.1002/we.2886.

J43 Stanislawski, B.J., R. Thedin, A. Sharma, E. Branlard, G. Vijayakumar, **M.A. Sprague**, 2023, Effect of the integral length scales of turbulent inflows on wind turbine loads, *Renewable Energy*, **217**, 119218, DOI: 10.1016/j.renene.2023.119218.

J42 Bidadi, S., G. Vijayakumar, A. Sharma, and **M.A. Sprague**, 2023, Mesh and model requirements for capturing deep-stall aerodynamics in low-Mach-number flows, *Journal of Turbulence*, **24**, 393–418, DOI: 10.1080/14685248.2023.2225141.

J41 Kuhn, M., G. Deskos, **M. Sprague**, 2023, A mass-momentum consistent coupling for mesh-adaptive two-phase flow simulations, *Computers and Fluids*, **252**, 105770, DOI: 10.1016/j.compfluid.2022.105770.

J40 Deskos, G., S. Ananthan, **M.A. Sprague**, 2022, Direct numerical simulations of turbulent flow over misaligned traveling waves. *International Journal of Heat and Fluid Flow*, **97**, 109029, DOI: 10.1016/j.ijheatfluidflow.2022.109029

J39 Quick, J., M. Henry de Frahan, S. Ananthan, **M.A. Sprague**, P. Hamlington, 2022, Field sensitivity analysis of turbulence model parameters for flow over a wing. *International Journal for Uncertainty Quantification* **12**, 85-106, DOI: 10.1615/Int.J.UncertaintyQuantification.2021036467.

J38 Deskos*, G., J. Lee, C. Draxl, **M.A. Sprague**, 2021, Review of wind-wave coupling models for large-eddy simulation of the marine atmospheric boundary layer, *Journal of the Atmospheric Sciences* **78**, 3025–3045, DOI: 10.1175/JAS-D-21-0003.1.

J37 Sharma*, A., S. Ananthan, J. Sitaraman, **M.A. Sprague**, 2021, Overset meshes for incompressible flows: On preserving accuracy of underlying discretization, *Journal of Computational Physics* **428**, 109987, DOI: 10.1016/j.jcp.2020.109987.

J36 Glaws*, A., R. King, and **M. Sprague**, 2020, Deep learning for in-situ data compression of large CFD simulations, *Physical Review Fluids* **5**, 114602, DOI: 10.1103/PhysRevFluids.5.114602.

J35 Alexander, F. et al. (51 authors), 2020, Exascale applications: Skin in the game, *Philosophical Transactions of the Royal Society A* **378**, 20190056, DOI: 10.1098/rsta.2019.0056.

J34 Thomas, S.J., S. Ananthan, S. Yellapantula, J.J. Hu, M. Lawson, and **M.A. Sprague**, 2019, A comparison of classical and aggregation-based algebraic multigrid preconditioners for high-fidelity simulation of wind-turbine incompressible flows, *SIAM Journal on Scientific Computing* **41**, S196-S219, DOI: 10.1137/18M1179018.

J33 Sitaraman, H., N. Danes, J. Lischeske, J. Stickel, and **M.A. Sprague**, 2019, Coupled CFD and chemical-kinetics simulations of cellulosic biomass enzymatic hydrolysis: mathematical model development and validation, *Chemical Engineering Science* **206**, 348–360, DOI: 10.1016/j.ces.2019.05.02.

J32 Li*, M., Z. Qiu, C. Liang, **M. Sprague**, M. Xu, and C.A. Garris, 2019, A new high-order spectral difference method for simulating viscous flows on unstructured grids with mixed-element meshes, *Computers and Fluids* **184**, 187–198, DOI: 10.1016/j.compfluid.2019.03.010.

J31 **Sprague*, M.A.**, J.J. Stickel, H. Sitaraman, and N. Crawford, 2018, Formulation and validation of a computational model for a dilute biomass slurry undergoing rotational mixing, *Chemical Engineering Science* **182**, 108–118, DOI: 10.1016/j.ces.2018.02.030.

J30 Guntur*, S., J. Jonkman, R. Sievers, **M.A. Sprague**, S. Schreck, and Q. Wang, 2017, A Validation and code-to-code verification of FAST for a MW-scale wind turbine with aeroelastically tailored blades, *Wind Energy Science* **2**, 443–468, DOI: 10.5194/wes-2-443-2017.

J29 Wang*, Q., **M.A. Sprague**, J. Jonkman, N. Johnson, and B. Jonkman, 2017, BeamDyn: An efficient high-fidelity wind turbine blade solver in the FAST modular framework, *Wind Energy* **20**, 1439-1462, DOI: 10.1002/we.2101.

J28 Crawford*, N.C., **M.A. Sprague**, and J.J. Stickel, 2016, Mixing behavior of a model cellulosic biomass slurry during settling and resuspension, *Chemical Engineering Science* **144**, 310–320, DOI: 10.1016/j.ces.2016.01.028.

J27 Zhang, C., S. Santhanagopalan*, **M.A. Sprague**, A.A. Pesaran, 2015, A representative-sandwich model for simultaneously coupled mechanical-electrical-thermal simulation of a lithium-ion cell under quasi-static indentation tests, *Journal of Power Sources* **298**, 309–321, DOI: 10.1016/j.jpowsour.2015.08.049.

J26 Weidman*, P.D. and **M.A. Sprague**, 2015, Steady and unsteady modeling of the float height of an air hockey disk, *Journal of Fluid Mechanics* **778**, 39–59, DOI: 10.1017/jfm.2015.374.

J25 **Sprague*, M.A.** and A. Purkayastha, 2015, Legendre spectral finite elements for Reissner-Mindlin composite plates, *Finite Elements in Analysis and Design* **105**, 33–43, DOI: 10.1016/j.finel.2015.06.007.

J24 Nag, A., **M.A. Sprague**, A.J. Griggs, J.J. Lischeske, J.J. Stickel*, A. Mittal, W. Wang, and D.K. Johnson, 2015, Parameter determination and validation for a mechanistic model of the enzymatic saccharification of cellulose-I$_\beta$, *Biotechnology Progress* **31**, DOI: 10.1002/btpr.2122.

J23 Zhang, C., S. Santhanagopalan*, **M.A. Sprague**, A.A. Pesaran, 2015, Coupled mechanical-electrical-thermal modeling for short-circuit prediction in a Lithium-ion cell under mechanical abuse, *Journal of Power Sources* **290**, 102–113, DOI: 10.1016/j.jpowsour.2015.08.049.

J22 **Sprague*, M.A.** and I. Satkauskas, 2015, Nesting an incompressible-flow code within a compressible-flow code: a two-dimensional study, *Computers and Fluids* **115**, 75–85, DOI: 10.1016/j.compfluid.2015.03.005.

J21 Sitaraman, H., E.M. Kuhn, A. Nag, **M.A. Sprague**, M.P. Tucker, and J.J. Stickel*, 2015, Multiphysics modeling and simulation of high-solids dilute-acid pretreatment of corn stover in a steam-explosion reactor, *Chemical Engineering Journal* **268**, 47–59, DOI: 10.1016/j.cej.2015.01.020.

J20 Brito, K.D. and **M.A. Sprague***, 2012, Reissner-Mindlin Legendre spectral finite elements with mixed reduced quadrature, *Finite Elements in Analysis and Design* **58**, 74–83, DOI: 10.1016/j.finel.2012.04.009.

J19 Weidman*, P.D. and **M.A. Sprague**, 2011, Flows induced by a plate moving normal to stagnation-point flow, *Acta Mechanica* **219**, 219–229, DOI: 10.1007/s00707-011-0458-2.

J18 **Sprague*, M.A.** and M.E. Colvin, 2011, A mixture-enthalpy fixed-grid model for temperature response and heterocyclic-amine formation in a frying beef patty, *Food Research International* **44**, 789–797, DOI: 10.1016/j.foodres.2011.01.011.

J17 **Sprague*, M.A.** and P.D. Weidman*, 2011, Three-dimensional flow induced by the torsional motion of a cylinder, *Fluid Dynamics Research* **43**, 015501 (12 pages), web link.

——————— Joined NREL on 12 July 2010 ———————

J16 Geers*, T.L. and **M.A. Sprague**, 2010, A residual-potential boundary for time-dependent, infinite-domain problems in computational acoustics, *Journal of the Acoustical Society of America* **127**, 675–682 DOI: 10.1121/1.3273900.

J15 **Sprague*, M.A.** and P.D. Weidman, 2009, Continuously tailored Taylor vortices, *Physics of Fluids* **21**, 114106 (8 pages) DOI: 10.1063/1.3268778.

J14 Long, M., **M.A. Sprague**, A.A. Grimes, B.D. Rich, and M. Khine*, 2009, A simple three-dimensional vortex micromixer, *Applied Physics Letters* **94**, 133501 (3 pages) 10.1063/1.3089816.

J13 Ross*, M., **M.A. Sprague**, C.A. Felippa, and K.C. Park, 2009, Treatment of acoustic fluid-structure interaction by localized Lagrange multipliers and comparison to alternative interface coupling methods, *Computer Methods in Applied Mechanics and Engineering* **198**, 986–1005, DOI: 10.1016/j.cma.2008.11.006.

J12 Ross*, M., C.A. Felippa, K.C. Park, and **M.A. Sprague**, 2008, Treatment of acoustic fluid-structure interaction by localized Lagrange multipliers: Formulation, *Computer Methods in Applied Mechanics and Engineering* **187**, 3057–3079, DOI: 10.1016/j.cma.2008.02.017.

J11 Serre, E., **M.A. Sprague**, and R.M. Lueptow*, 2008, Stability of Taylor-Couette flow in a finite-length cavity with radial throughflow, *Physics of Fluids* **20**, 034106 (10 pages), DOI: 10.1063/1.2884835.

J10 **Sprague*, M.A.**, P.D. Weidman, S. Macumber, and P.F. Fischer, 2008, Tailored Taylor vortices, *Physics of Fluids* **20**, 014102 (9 pages), DOI: 10.1063/1.2831493.

J9 **Sprague*, M.A.** and T.L. Geers, 2008, Legendre spectral finite elements for structural dynamics analysis, *Communications in Numerical Methods in Engineering* **24**, 1953–1965, DOI: 10.1002/cnm.1086.

J8 **Sprague*, M.**, K. Julien, E. Knobloch, and J. Werne, 2006, Numerical simulation of an asymptotically reduced system for rotationally constrained convection, *Journal of Fluid Mechanics* **551**, 141–174, DOI: 10.1017/S0022112005008499.

J7 **Sprague*, M.A.** and T.L. Geers, 2006, A spectral-element/finite-element analysis of a ship-like structure subjected to an underwater explosion, *Computer Methods in Applied Mechanics and Engineering* **195**, 2149–2167, DOI: 10.1016/j.cma.2005.03.007.

——————— Joined UC Merced on 01 July 2005 ———————

J6 **Sprague*, M.A.** and T.L. Geers, 2004, A spectral-element method for modeling cavitation in transient fluid-structure interaction, *International Journal for Numerical Methods in Engineering* **60**, 2467–2499, DOI: 10.1002/nme.1054.

J5 **Sprague*, M.A.** and T.L. Geers, 2003, Spectral elements and field separation for an acoustic fluid subject to cavitation, *Journal of Computational Physics* **184**, 149–162, DOI: 10.1016/S0021-9991(02)00024-4.

J4 **Sprague*, M.A.** and T.L. Geers, 2001, Computational treatments of cavitation effects in near-free-surface underwater shock analysis, *Shock and Vibration* **8**, 105–122, web link.

J3 **Sprague*, M.A.** and T.L. Geers, 1999, Response of empty and fluid-filled, submerged spherical shells to plane or spherical, step-exponential waves, *Shock and Vibration* **6**, 147–157, web link.

J2 **Sprague, M.**, W. Semke, R. Engelstad*, E. Lovell, A. Chalupka, H. Löschner, and G. Stengle, 1998, Stencil mask distortion control using nonsymmetric perforation rings, *Microelectronic Engineering* **41/42**, 225–228, DOI: 10.1016/S0167-9317(98)00051-3.

J1 Shamoun*, B., **M. Sprague**, F. Bedford, and R. Engelstad, 1998, X-ray mask distortions during e-beam patterning, *Microelectronic Engineering* **41/42**, 283–286, DOI: 10.1016/S0167-9317(98)00065-3.

Book Chapter

B1 Robinson, M.C. and **M.A. Sprague**, 2019, Looking Forward: The promise and challenge of exascale computing. In P. Veers (Ed.), *Wind Energy Modeling and Simulation, Volume 1: Atmosphere and Plant* (pp. 1-22). Stevenage, UK; Institution of Engineering and Technology. Chapter DOI: 10.1049/PBPO125F_ch1; Book DOI: 10.1049/PBPO125F

Published Conference Proceedings

C24 Cheung, L., A. Hsieh, M. Blaylock, T. Herges, N. deVelder, K. Brown, P. Sakievich, D. Houck, D. Maniaci, C. Kaul, R. Rai, N. Hamilton, A. Rybchuk, R. Scott, R. Thedin, M. Brazell, M. Churchfield, M. Sprague, 2023, Investigations of Farm-to-Farm Interactions and Blockage Effects from AWAKEN Using Large-Scale Numerical Simulations, *Journal of Physics: Conference Series*, **2505**, 012023. Proceedings from the Wake Conference 2023. https://iopscience.iop.org/article/10.1088/1742-6596/2505/1/012023/pdf

C23 Beig, S.A., G.R. Whitehouse, A.H. Boschitsch, A. Sharma, M.J. Brazell, M.T. Henry de Frahan, and M.A. Sprague, Developing a vorticity-velocity-based off-body solver to perform multifidelity simulations of wind farms. Proceedings of AIAA SciTech 2023.

C22 Adcock, C., M. Henry de Frahan, J. Melvin, G. Vijayakumar, S. Ananthan, G. Iaccarino, R. Moser, and M. Sprague, Hybrid RANS-LES of the atmospheric boundary layer for wind farm simulations, Presented at the AIAA SCITECH 2022 Forum San Diego, California January 3-7, 2022. https://www.nrel.gov/docs/fy22osti/82244.pdf

C21 Mullowney, P., R. Li, S. Thomas, S. Ananthan, J.S. Rood, A.B. Williams, and **M.A. Sprague**, Preparing an Incompressible-Flow Fluid Dynamics Code for Exascale-Class Wind Energy Simulations, Presented at the International Conference for High Performance Computing, Networking, Storage, and Analysis (SC21), 14–19 Nov 2021. https://www.nrel.gov/docs/fy22osti/81212.pdf

C20 Grinderslev, C., and G. Vijayakumar, and S. Ananthan, an N.N. Sørensen, F. Zahle, and **M.A. Sprague**, 2020, Validation of blade-resolved computational fluid dynamics for a MW-scale turbine rotor in atmospheric flow, Journal of Physics: Conference Series, **1618**, 052049, doi:10.1088/1742-6596/1618/5/052049. Proceedings of *The Science of Making Torque from Wind (TORQUE 2020)*.

C19 **Sprague, M.A.**, S. Ananthan, G. Vijayakumar, and M. Robinson, 2020, ExaWind: A multi-fidelity modeling and simulation environment for wind energy, *Journal of Physics: Conference Series* **1452** 012071. DOI: 10.1088/1742-6596/1452/1/012071. Proceedings of *NAWEA WindTech 2019*, UMass Amherst, MA, October 14-17, 2019.

C18 **Sprague, M.A.**, S. Bodyrev, C.-S. Chang, P. Fischer, R. Grout, W.I. Gustafson Jr., J.A.F. Hittinger, E. Merzari, and R. Moser. Outcomes from the DOE Workshop on Turbulent Flow Simulation at the Exascale. Proceedings of *AIAA Aviation 2016*, Washington, D.C., 13–17 June 2016.

C17 Wang, Q., **M. Sprague**, J. Jonkman, and B. Jonkman, Partitioned nonlinear structural analysis of wind turbines using BeamDyn. Proceedings of *34th Wind Energy Symposium, AIAA Science and Technology Forum and Exposition 2016*, San Diego, California, 4–8 January 2016.

C16 Guntur, S., J. Jonkman, S. Schreck, B. Jonkman, Q. Wang, **M. Sprague**, M. Hind, and R. Sievers, FAST v8 Verification and Validation Using Experiments from Aeroelastically Tailored Megawatt-Scale Wind Turbine Blades. Proceedings of *34th Wind Energy Symposium, AIAA Science and Technology Forum and Exposition 2016*, San Diego, California, 4–8 January 2016, https://www.nrel.gov/docs/fy16osti/65389.pdf

C15 Pavese, C., Q. Wang, T. Kim, J. Jonkman, and **M.A. Sprague**, HAWC2 and BeamDyn: Comparison between beam structural models for aero-servo-elastic frameworks, proceedings of *EWEA 2015*, Paris, 17–20 November 2015, https://www.nrel.gov/docs/fy16osti/65115.pdf.

C14 **Sprague, M.A.**, J.M. Jonkman, and B.J. Jonkman, FAST modular framework for wind turbine simulation: New algorithms and numerical examples, proceedings of the *AIAA Science and Technology Forum and Exposition, 33rd ASME Wind Energy Symposium*, Kissimmee, FL, 5–9 January 2015, https://www.nrel.gov/docs/fy16osti/63203.pdf.

C13 Wang, Q., N. Johnson, **M.A. Sprague**, J. Jonkman, BeamDyn: A high-fidelity wind turbine blade solver in the FAST modular framework. Proceedings of the *AIAA Science and Technology Forum and Exposition, 33rd ASME Wind Energy Symposium*, Kissimmee, FL, 5–9 January 2015, https://www.nrel.gov/docs/fy15osti/63165.pdf.

C12 **Sprague, M.A.**, J.M. Jonkman, and B.J. Jonkman, FAST Modular wind turbine CAE tool: Nonmatching spatial and temporal meshes. Proceedings of the *AIAA Science and Technology Forum and Exposition, 32nd ASME Wind Energy Symposium*, National Harbor, MD, January 13–17, 2014; also published as tech. report NREL/CP-2C00-60742, National Renewable Energy Laboratory, Golden, CO, https://www.nrel.gov/docs/fy14osti/60742.pdf.

C11 Wang, Q., **M.A. Sprague**, and J.M. Jonkman, Nonlinear Legendre spectral finite elements for wind turbine blade dynamics. Proceedings of the *AIAA Science and Technology Forum and Exposition, 32nd ASME Wind Energy Symposium*, National Harbor, MD, January 13–17, 2014, https://www.nrel.gov/docs/fy14osti/60759.pdf.

C10 Wang, Q., and **M.A. Sprague**, A Legendre spectral finite element implementation of geometric exact beam theory. Proceedings of the *54th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference*, Boston, MA, April 8–11, 2013, .

C9 Wang, Q., W. Yu, and **M.A. Sprague**, Geometric nonlinear analysis of composite beams using Wiener-Milenković parameters. Proceedings of the *54th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference*, Boston, MA, April 8–11, 2013.

C8 Gasmi, A., **M.A. Sprague**, J.M. Jonkman, and W.B. Jones, Numerical stability and accuracy of temporally coupled multi-physics modules in wind-turbine CAE tools. Proceedings of the *51st AIAA Aerospace Sciences Meeting*, Grapevine, TX, January 7–10, 2013.

C7 **Sprague, M.A.**, P. Moriarty, M. Churchfield, S. Lee, J. Lundquist, J. Michalakes, and A. Purkayastha, Computational modeling of wind plant aerodynamics. Proceedings of *Scientific Discovery through Advanced Computing 2011*, Denver, CO, July 10-14, 2011.

C6 Weidman, P.D., **M.A. Sprague**, S. Macumber, Tailored Taylor vortices. *Proceedings of the 15th International Couette-Taylor Workshop*, Le Havre, France, July 9-12, 2007.

C5 Serre, E., **M. Sprague**, P. Bontoux, R.M. Lueptow, The effect of radial through-flow on the stability of Taylor-Couette flow. *Proceedings of the 15th International Couette-Taylor Workshop*, Le Havre, France, July 9-12, 2007.

C4 **Sprague, M.**, K. Julien, E. Serre, J.J. Sánchez-Álvarez, and E. Crespo del Arco, Pattern formation in Rayleigh-Bénard convection in a rapidly rotating cylinder, *Proceedings of the Fourth International Symposium on Turbulence and Shear Flow Phenomena*, 2005, pp. 1089-1094.

C3 Sánchez-Álvarez, J.J., Serre, E., **M. Sprague**, E. Crespo del Arco, and F. Busse, 2005, Numerical investigations of transition to spatio-temporal chaos in rotating Rayleigh-Bénard convection, *Proceedings of 4th International Conference on Computational Heat and Mass Transfer*, May 17–20, 2005, Paris-Cachan, France.

C2 Mikkelson, A., **M. Sprague**, R. Engelstad, E. Lovell, and D. Trost, Mechanical distortions in advanced optical reticles, *Proceedings of the 1998 SPIE Symposium on Emerging Lithographic Technologies II*, SPIE, Vol. 3331, pp. 601-611, 1998.

C1 Fisher, A., **M. Sprague**, R. Engelstad, D. Laird, and S. Nash, Stability and stiffness characteristics of the National X-ray Mask Standard, *Proceedings of the SPIE 1997 Symposium on Electron-Beam, X-ray, EUV, and Ion-Beam Submicrometer Lithographies for Manufacturing*, 1997, pp. 288-298.

Selected Workshop/Technical Reports

TR4 Sieger, M. et al., 2023, *Computational Requirements in Clean Energy and Manufacturing: Summary report of the virtual workshop held on June 28-29, 2021. United States*, Technical Report ORNL/SPR-2023/2707, Oak Ridge National Laboratory, doi:10.2172/1971039, web link.

TR3 Maniaci, D.C., P.J. Moriarty, M.F. Barone, M.J. Churchfield, **M.A. Sprague.**, S. Arunajatesan, 2020, *Wind Energy High-Fidelity Model Verification and Validation Roadmap*, Technical Report SAND2020-1332, Sandia National Laboratories, web link.

TR2 **Sprague, M.A.**, S. Boldyrev, P. Fischer, R. Grout, W.I. Gustafson, R. Moser, 2017, *Turbulent Flow Simulation at the Exascale: Opportunities and Challenges Workshop: August 4-5, 2015, Washington, D.C.*, Technical Report NREL/TP-2C00-67648, National Renewable Energy Laboratory, 2017, web link, DOI: 10.2172/1338668.

TR1 Hammond, S.W., **M.A. Sprague**, D. Womble, M. Barone, 2015, *A2e High Fidelity Modeling: Strategic Planning Meetings,* Technical Report NREL/TP-2C00-64697, National Renewable Energy Laboratory, web link, DOI: 10.2172/1327211.

White Papers

WP3 **Sprague, M.**, S. Hammond, D. Womble, M. Barone, The Atmosphere to Electrons (A2e) Initiative, Wind Plant Simulations, and Exascale Computing, DOE ASCR Turbulent Flow Simulation at the Exascale: Opportunities and Challenges Workshop, 3–4 August 2015, Washington, DC.

WP2 Churchfield, M. and **Sprague, M.**, Exascale Computing and Wind Energy, DOE ASCR Turbulent Flow Simulation at the Exascale: Opportunities and Challenges Workshop, 3–4 August 2015, Washington, DC.

WP1 Graf, P., **M. Sprague**, and R. Grout, Coupling of hierarchical multiphysics models and other mathematical issues in extreme scale computing, ASCR Exascale Math Working Group Workshop, 21–22 August 2013, Washington, DC.

PRESENTATIONS

(only listed are talks for which M. Sprague was presenting author)

Invited Talks

38. Exascale supercomputing and predictive wind energy simulations, Applied and Computational Math Seminar, University of Wisconsin Madison, 1 November 2024.
37. ExaWind: An open-source GPU-ready code suite for wind energy, TotalEnergies MATHIAS Days 2024, Paris, France, 25 September 2024.
36. Exascale computing, AI, and achieving the Floating Offshore Wind Energy Earthshot, AI Expo, Washington, D.C., 8 May 2024.
35. Exascale supercomputing and predictive wind energy simulations, Applied Math Seminar, University of California, Merced, 27 February 2024.
34. The Exascale Computing Project and ExaWind, Keynote Presentation, TotalEnergies MATHIAS 2023, Paris, France, 4 October 2023.
33. ExaWind: Hybrid CFD on Hybrid HPC, Keynote Presentation, Sixth EAGE High Performance Computing Workshop, Milan, Italy, 19 September 2022
32. ExaWind: Opportunity for Discovery, Exascale Computing Project, Annual Meeting, Virtual, 4 May 2022, slides
31. High Fidelity Modelling Capabilities in NREL for Wind Energy, co-presented with S. Srinivas and G. Vijayakumar, SPE International Gulf Coast Section, Computational Fluid Dynamics Webinar, 31 March 2022
30. Predictive simulations of wind turbines on next-generation supercomputers, USACM CFD/FSI Virtual Seminar, 9 December 2021, recording
29. ExaWind: Predictive wind energy simulations, SC High Performance 2021 Digital, 1 July 2021, slides
28. Wind energy research and next-generation HPC, Computational Mission Needs in Clean Energy and Manufacturing Workshop, 28-29 June 2021
27. The future of high-performance computing for wind energy, co-presented with S. Ananthan, G. Vijaykumar, and L. Martinez-Tossas, Wind Energy Leadership Series webinar, National Renewable Energy Laboratory, 30 July 2020
26. Exawind open-source computational fluid dynamics for wind turbines and wind farms, keynote presentation, ASME Fluids Engineering Division Summer Meeting, Virtual Conference, 13 July 2020
25. HFM & HPC as the foundation for reducing the cost of wind energy, DOE Wind Energy Technolgies Office, Washington, D.C., 18 December 2018
24. ExaWind: Towards predictive wind farm simulations on exascale platforms, SuperComputing 2018 (SC18), DOE-Booth NREL Featured Speaker, Dallas, 14 November, 2018
23. Multi-scale challenges of blade-resolved wind turbine simulations, 2018 Smoky Mountains Computational Sciences and Engineering Conference (SMC2018), Gatlinburg, Tennessee, 29 August 2018
22. ExaWind: Exascale Predictive Wind Plant Flow Physics Modeling, CEED Annual Meeting, Boulder, CO, 9 August 2018
21. Outcomes from the DOE Workshop on Turbulent Flow Simulation at the Exascale, ASME Fluids Engineering Division Summer Meeting, Waikoloa, Hawaii, July 30 – August 3, 2017
20. Towards predictive wind plant simulations at the exascale, DOE Office of Science, Advanced Computational Crosscut Team, HPC & HFM Webinar Series, 26 April 2017
19. A computational model for a dilute biomass suspension undergoing mixing and settling, Applied Mathematics & Statistics Colloquium, Colorado School of Mines, 10 March 2017
18. Outcomes from the DOE Workshop on Turbulent Flow Simulation at the Exascale, AIAA Aviation and Aeronautics Forum and Exposition 2016, Washington, D.C., 13 June 2016
17. Wind Plant Flow Physics, 57^{th} HPC User Forum, Broomfield, Colorado, 10 September 2015
16. Computational modeling of dilute biomass slurries, Boulder Fluids Seminar, University of Colorado at Boulder, 04 February 2014

15. Coupling meso-scale and micro-scale fluid dynamics codes for wind-energy computing: A two-dimensional study, Computational Mathematics Seminar, University of Colorado at Boulder, 29 October 2013
14. Coupling meso-scale and micro-scale fluid dynamics codes for wind-energy computing: A two-dimensional study, Workshop on Atmospheric Modeling at LES Scales: Opportunities and Challenges, Argonne National Laboratory, 4 September 2013
13. Code validation for biomass flows, HPC@NREL 2012 Workshop, National Renewable Energy Laboratory, Golden, August 2012
12. Coupling meso- and micro-scale fluid dynamics codes for wind-energy computing, 4th Annual CREW symposium, Colorado State University, Fort Collins, August 2012
11. Coupled fluid-dynamics and population-balance kinetic models for enzymatic hydrolysis of biomass, Computational Math Seminar, Univ. of Colorado, Boulder, April 2012
10. Model coupling for multi-scale wind-energy computing, 3rd Annual CREW symposium, National Renewable Energy Lab, Golden, CO, August 2011
9. Numerical simulation of an asymptotically reduced system for rotationally constrained convection, Applied Mathematics & Statistics Seminar, Univ. of California, Santa Cruz, March 2009
8. Numerical simulation of an asymptotically reduced system for rotationally constrained convection, Applied Mathematics Seminar, Univ. of California, Berkeley, March 2006
7. Numerical investigation of a reduced set of equations for rapidly rotating convection, Applied Mathematics Colloquium, Univ. of Colorado, Boulder, March 2005
6. Numerical investigation of a reduced set of equations for rapidly rotating convection, SIAM Undergraduate Chapter Seminar, Univ. of Colorado, Boulder, November 2004
5. Numerical simulation of a reduced set of equations for rapidly rotating convection, Laboratoire de Modélisation en Mécanique à Marseille, France, July 2004
4. A spectral-element method for modeling cavitation in transient fluid-structure interaction, Fast Algorithms Seminar, Univ. of Colorado, Boulder, November 2003
3. A spectral-element method for modeling cavitation in transient fluid-structure interaction, Department of Mechanical Engineering Graduate Seminar Series, Univ. of Colorado, Boulder, 2003
2. Mapped-domain analysis for underwater shock problems, Naval Surface Warfare Center, Carderock Division, July 2000
1. Characterization of the friction properties of ceramic powders, Material Science Seminar, Los Alamos National Laboratory, November 1996

Contributed Talks

23. Nalu-Wind/OpenFAST: A multi-fidelity modeling and simulation environment for wind energy, NAWEA WindTech 2019 Conference, UMass Amherst, MA, 14-17 October 2019.
22. ExaWind: Multi-scale Challenges of Massively Parallel Blade-resolved Wind Turbine Simulations, SIAM Conference on Computational Science and Engineering (CSE19), Spokane, WA, 25 February 2019
21. Formulation and validation of a computational model for a dilute biomass slurry undergoing rotational mixing, American Physical Society Division of Fluid Dynamics Meeting, Denver, CO, 19-21 November 2017
20. FAST Modular Framework for Wind Turbine Simulation: New Algorithms & Numerical Examples, AIAA Science and Technology Forum and Exposition, 33rd ASME Wind Energy Symposium, Kissimmee, FL, 7 January 2015
19. Legendre Spectral Finite Elements for Reissner-Mindlin Composite Plates, International Conference on Spectral and High Order Methods (ICOSAHOM), Salt Lake City, UT, 23 June 2014
18. FAST modular wind turbine CAE tool: Nonmatching spatial and temporal meshes, AIAA Science and

Technology Forum and Exposition, 32nd ASME Wind Energy Symposium, National Harbor, MD, 14 January 2014

17. A comparison of direct and indirect solvers for Reissner-Mindlin Legendre spectral finite elements, 12^{th} U.S. National Congress on Computational Mechanics (USNCCM12), Raleigh, NC, 25 July 2013
16. Computational modeling of dilute biomass slurries, American Physical Society Division of Fluid Dynamics Meeting, San Diego, CA, November 2012
15. Coupled fluid-dynamics and population-balance kinetic models for enzymatic hydrolysis of biomass, AIChE Annual Meeting, Minneapolis, MN, October 2011
14. A comparison of Nek5000 and OpenFOAM for DNS of turbulent channel flow, Nek5000 User Meeting, Argonne National Lab, December 2010
13. Continuously Tailored Taylor Vortices, 16^{th} International Couette-Taylor Workshop, Princeton, NJ, September 2009
12. 3D shrinky-dink vortex micromixer: Efficient mixing at low Reynolds numbers, American Physical Society Division of Fluid Dynamics Meeting, San Antonio, TX, November 2008
11. Large-scale numerical simulation of rotationally constrained convection, American Physical Society Division of Fluid Dynamics Meeting, Salt Lake City, UT, November 2007
10. Numerical simulation of an asymptotically reduced system for rotationally constrained convection, SIAM Conference on Mathematical & Computational Issues in the Geosciences, Santa Fe, NM, March 2007
9. Numerical simulation of an asymptotically reduced system for rotationally constrained convection, SIAM Conference on Nonlinear Waves and Coherent Structures, Seattle, WA, September 2006
8. Spectral finite elements for structural dynamics analysis, United States Congress on Theoretical and Applied Mechanics, Boulder, CO, June 2006
7. Reduced equations for rapidly rotating convection in a cylinder, American Physical Society Division of Fluid Dynamics Meeting, Chicago, IL, November 2005
6. Pattern formation in Rayleigh-Benard convection in a rapidly rotating cylinder, Fourth International Symposium on Turbulence and Shear Flow Phenomena, Williamsburg, VA, June 2005
5. Numerical simulation of a reduced set of equations for rapidly rotating convection, American Physical Society Division of Fluid Dynamics Meeting, Seattle, WA, November 2004
4. Numerical simulation of a reduced set of equations for rapidly rotating convection on the tilted f-plane, American Geophysical Union Ocean Sciences Meeting, Portland, OR, February 2004
3. Numerical simulation of a reduced set of equations for rapidly rotating convection on the tilted f-plane, American Physical Society Division of Fluid Dynamics Meeting, East Rutherford, NJ, November 2003
2. A spectral-element method for modeling cavitation in transient fluid-structure interaction, 7^{th} U.S. National Congress on Computational Mechanics, Albuquerque, NM 2003
1. USA-CFA-based methods for near-free-surface shock analysis, 70^{th} Shock and Vibration Symposium, Albuquerque, NM, 1999

Outreach Talks

7. Computer simulations vs. the real world, *Frontiers of Science & Engineering Lecture Series*, Castle Science & Technology Center, Atwater, CA, 27 February 2010
6. Panel member at *Northern California Forum for Diversity in Graduate Education*, University of California, Santa Cruz, 07 November 2009
5. Panel member at *Northern California Forum for Diversity in Graduate Education*, University of California, Berkeley, 08 November 2008
4. Applied mathematics graduate studies, *CSU Stanislaus Math and CS Speaker Series*, 25 April 2008
3. Computer simulations vs. the real world, *Frontiers of Science & Engineering Lecture Series*, Castle Science & Technology Center, Atwater, CA, 17 November 2007

2. Presentation regarding UC Merced Applied Math to Math and Physics students, Mariposa High School, 06 November 2007
1. Applied mathematics graduate studies, *CSU Stanislaus Math and CS Speaker Series*, 20 April 2007

FUNDING

Floating Offshore Wind Modeling and Simulation (FLOWMAS) Energy Earthsho Research Center
Awarding Agency: DOE Office of Science, ASCR and BER
Director: M.A. Sprague
Award Description: $19M over four years, 7 institution project focused on the DOE Floating Offshore Wind Shot
Award Period: September 2023 – September 2025 *Note:* Entire EERC Program was terminated in 2025

High-fidelity Modeling
Awarding Agency: DOE EERE Wind Energy Technologies Office
Principal Investigator: M.A. Sprague
Award Description: Merit-reviewed project split between NREL and SNL for high-fidelity modeling of wind turbines and wind farms; multi-lab annual budget of around $2.5M - $3M
Award Period: March 2016 – present

OpenTurbine
Awarding Agency: DOE EERE Wind Energy Technologies Office *PI:* M.A. Sprague
Award Description: NREL and Sandia project to create a performance porttable flexible multi-body-dynamics code for wind energy; $1.5M over three years
Award Period: 2023 – 2025

Exascale Predictive Wind Plant Flow Physics Modeling
Awarding Agency: Exascale Computing Project, DOE Office of Science
Principal Investigator: M.A. Sprague
Award Description: Create an exascale-ready wind plant simulation capability; project split across four institutions with annual budget of about $3M
Award Period: 2016 – 2024

Intel Parallel Computing Center: OpenFAST: Wind Turbine Simulation Tool
Awarding Agency: Intel
Principal Investigator: M.A. Sprague
Award Description: Grant to parallelize the OpenFAST code
Award Period: Nov 2016 – Dec 2018

Wind Plant Flow Physics
Awarding Agency: NREL Laboratory Directed Research & Development
Investigators: M.A. Sprague (PI), S. Hammond
Award Description: NREL internal grant
Award Period: Feb 2016 – Sept 2016

Visualization for FAST v8
Awarding Agency: NREL Model & Tool Investment Fund
Investigators: M.A. Sprague (PI), K. Gruchalla, J. Jonkman, B. Jonkman
Award Description: NREL internal grant
Award Period: Oct 2015 – June 2016

Integrated Systems Design and Analysis
Awarding Agency: DOE EERE Wind and Water Power Technologies Office
Investigators: M.A. Sprague (PI), K. Dykes, P. Veers
Award Description: AOP Funding

Award Period: Oct 2015 – Sept 2016

A2e: High-fidelity Modeling and Validation
Awarding Agency: DOE EERE Wind and Water Power Technologies Office
Investigators: M.A. Sprague (Co-PI), J. Jonkman (Co-PI), A. Robertson
Award Description: AOP Funding
Award Period: Oct 2014 – Sept 2015

Next-generation multi-scale computational fluid dynamics for wind farm simulations
Awarding Agency: NREL Laboratory Directed Research & Development
Investigators: M.A. Sprague (PI), M. Churchfield
Award Description: NREL internal grant
Award Period: Oct 2014 – Sept 2015

High-fidelity computational modeling of wind-turbine structural dynamics
Awarding Agency: NREL Laboratory Directed Research & Development
Investigators: M.A. Sprague (PI), S. Schreck & P. Veers
Award Description: NREL internal grant
Award Period: Oct 2011 – Dec 2013

Model coupling for multi-scale wind-energy computing
Awarding Agency: Center for Research and Education in Wind (CREW)
Investigators: M.A. Sprague (PI), J.G. Michalakes, J.K. Lundquist
Award Period: June 2011 – May 2012

Hydrodynamics control by highly accurate numerical simulation and modeling of the filtering processes and membrane separation.
Awarding Agency: Centre National de la Reserche Scientifique (CNRS, France)
Investigators: Co-PIs: E. Serre (CNRS), M. Sprague, R. Lueptow (Northwestern University)
Award Description: 8000 euro/year for three years to support travel of French researchers to collaborate with M. Sprague and R. Lueptow in the USA.
Award Period: 2006 – 2008

COMPUTER TIME AWARDS

High-fidelity modeling and next-generation surrogate models for floating offshore wind energy
Awarding Agency & Division: U.S. DOE ASCR Leadership Computing Challenge (ALCC)
Investigators: M. Sprague (PI), A. Almgren, L. Cheung, A. Lattanzi, S. Slattery, M. Taylor, G. Vijayakumar
Award Description: 0.5 million node hours on OLCF Frontier
Award Period: 2024-2025

Grand-challenge predictive wind farm simulations
Awarding Agency & Division: U.S. DOE ASCR Leadership Computing Challenge (ALCC)
Investigators: M. Sprague (PI), J. Rood, P. Sakievich, A. Sharma, G. Vijayakumar, L. Chueng
Award Description: 4 million node hours on OLCF Frontier
Award Period: 2023-2024

Unlocking Wind Farm Dynamics to Secure a Sustainable Energy Future
Awarding Agency & Division: U.S. DOE ASCR Leadership Computing Challenge (ALCC)
Investigators: M. Sprague (PI), L. Cheung, G. Deskos, P. Mullowney, P. Sakievich, G. Vijayakumar
Award Description: 800,000 node hours on OLCF Summit
Award Period: 2022-2023

Towards Predictive Exascale Wind Farm Simulations
Awarding Agency & Division: U.S. DOE INCITE Leadership Computing
Investigators: M. Sprague (PI), S. Ananthan, M. Barone, S. Domino, S. Hammond, S. Thomas

Award Description: 115 million core-hours (Mira and Theta) to create new predictive simulation capabilities that will lower the cost of wind energy
Award Period: CY2018 *Link:* https://www.alcf.anl.gov/projects/towards-predictive-exascale-wind-farm-simulations

Predictive Simulations of Complex Flow in Wind Farms
Awarding Agency & Division: U.S. DOE ASCR Leadership Computing Challenge (ALCC)
Investigators: M. Barone (PI), M. Sprague, S. Domino, M. Churchfield
Award Description: 10.7M Processor hours at the National Energy Research Scientific Computing Center (NERSC), Cori
Award Period: 2016-2017

Multi-scale modeling and computation of convective geophysical turbulence
Awarding Agency & Division: NASA 2007 National Leadership Computing System (NLCS)
Investigators: K. Julien (PI), M. Sprague, J. Werne, J. Weiss
Award Description: 1.25 million hours of CPU time on the 2048-processor Columbia supercomputer to perform numerical simulations for rotationally constrained convection.
Award Period: 01 April 2007 – 31 March 2008

JOURNAL REFEREE

AIAA Journal
Acta Mechanica
Applied Numerical Mathematics
Archive of Applied Mechanics
ASME Journal of Solar Energy Engineering
Biotechnology Progress
Energy Technology
Energy
Eng. Science & Tech.: an Int. Journal
Finite Elements in Analysis and Design
Int. J. of Computational Methods
Int. J. of Non-Linear Mechanics
Int. J. of Numerical Meth. in Fluids
Journal of Fluid Mechanics
Journal of Geophysics and Engineering
Journal of Physics D: Applied Physics
Journal of Renewable and Sustainable Energy
Measurement Science and Technology
New Journal of Physics
Ocean Engineering
Physics of Fluids
Sensors
Wind Energy
Annales Polonici Mathematici
Applied Acoustics
Applied Sciences
ASME Journal of Vibration and Acoustics
Computer Methods in Applied Mech. & Eng.
Engineering Structures
Engineering with Computers
Fluid Dynamics Research
Int. J. of Heat and Mass Transfer
Int. J. of Numerical Meth. in Eng.
Journal of Computational Physics
Journal of Fluids Engineering
Journal of Physics A: Math. and Theo.
Journal of Sound and Vibration
Mathematical and Computational Applications
Nonlinearity
Physical Review E
Physical Review Letters
Structural Engineering and Mechanics
Wind Engineering

TEACHING EXPERIENCE (Course webpages and Student-Questionaire results found on Homepage)

Assistant Professor, School of Natural Sciences, Univ. of California, Merced

- Spring 2010: MATH 292 (graduate) – Special Topics: Fluid Dynamics
- Spring 2009: MATH 21 – Calculus 1

- Fall 2008: MATH 232 (graduate) – Numerical Methods for PDEs
- Fall 2008: MATH 399 (graduate) – University Teaching
- Fall 2007: MATH 21 – Calculus 1
- Fall 2007: MATH 131 – Numerical Analysis 1
- Spring 2007: MATH 232 (graduate) – Numerical Methods for PDEs
- Fall 2006: MATH 24 – Introduction to Linear Algebra & Differential Equations
- Fall 2005: MATH 21 – Calculus 1

Postdoctoral Instructor, Applied Mathematics, Univ. of Colorado at Boulder

- Fall 2004/Spring 2005: Intermediate Numerical Analysis I & II, Senior-level course
- Spring 2004: Calculus 1 for Engineers
- 2004–2005: Advised various research projects for graduate & undergraduate students
- Fall 2003: Calculus 1 for Engineers

Adjunct Professor, Mechanical Engineering, Univ. of Colorado at Boulder

- Spring 2003: Computational Methods, a required Senior-level course
- Spring 2003: Finite-Element Consultant: Guided Senior-Design groups with the finite-element-analysis portion of their projects.
- Fall 2002: System Dynamics, a required Senior-level course; Nominated for the Sullivan-Carlson Innovation in Teaching Award

Substitute Lecturer

- Engineering Math I and II, Vibrations, Fluid Dynamics, and Numerical Analysis (all graduate)

Teaching Assistant

- System Dynamics (undergraduate; Outstanding TA Award)
- Senior Lab (undergraduate)
- Vibrations (graduate)
- Engineering Math I (graduate)
- Computational Methods (undergraduate)

Lead Graduate Teacher, Graduate Teacher Program, University of Colorado, 1998–2000

HONORS & AWARDS

- DOE Secretary's Honor Award, Exascale Computing Project Team, 2025
- Best Reviewer's Award, ASME Journal of Solar Energy Engineering, 2023
- President's Award, National Renewable Energy Laboratory, 2017
- President's Award, National Renewable Energy Laboratory, 2014
- President's Award, National Renewable Energy Laboratory, 2011
- NSF VIGRE Postdoctoral Scholar, 2003 - 2005
- Young Investigator Fellowship, 7^{th} US National Congress on Computational Mechanics, 2003
- Achievement Rewards for College Scientists (ARCS) Scholarship, 1999-2002
- Outstanding TA Award, Univ. of Colorado at Boulder, Mechanical Engineering, Fall 2001

- NSF Computer Science, Engineering, and Mathematics Scholarship (CSEMS), 2000/2001
- Graduate School University Fellowship, Univ. of Colorado at Boulder, 1997, 2000, 2002
- DOE Science & Engineering Research Semester (SERS) Fellowship, Fall 1996

PROFESSIONAL SOCIETIES

- Member American Society of Mechanical Engineers (1994–2011, 2016–)
- Member Society for Industrial and Applied Mathematics (2006–) !
- Member American Physical Society (lapsed)
- Member American Geophysical Union (lapsed)

INSTITUTIONAL SERVICE

NREL

- Member of the NREL Research Council (2014-2016)
- Commitee member for the NREL Director's Postdoctoral Fellowship program (2017–2019)

University of California–Merced

- Faculty Coordinator, Graduate Studies in Applied Mathematics (2005-2009)
- Committee Member for 10 faculty searches over 2005-2010, including those in applied math, mechanical engineering, and chemistry
- Chair of Natural Sciences Committee on Committees, Natural Sciences Executive Committee (2007-2008)
- Committee Member, Campus wide Strategic Academic Planning (2007-2008)
- Member at Large, School of Natural Sciences Executive Committee (2006-2007)
- Committee Member, School of Natural Sciences NS Curriculum Committee (2005-2006)
- Mechanical Engineering Curriculum Development; One of three faculty who developed undergraduate curriculum for Mechanical Engineering major (2005-2006)

University of Colorado at Boulder

- Graduate Liaison, Department of Mechanical Engineering; Voting member of the Graduate Committee (1999-2002)

University of Wisconsin–Madison

- Tutor, Greater University Tutoring Service (1995)

REFERENCES

Please contact me for references.