APPLIED MATHEMATICS SEMINAR SERIES
Exascale supercomputing and predictive wind energy simulations

Dr. Michael Sprague
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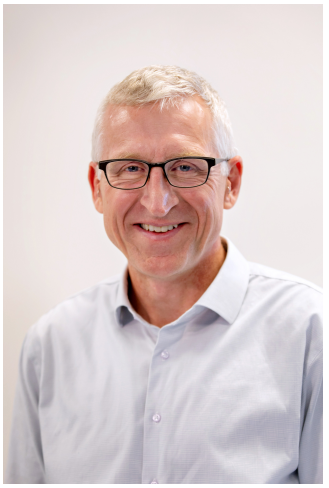
Time:
3:00 PM–4:15 PM

Location:
COB2 170

About The Speaker:



Dr. Michael Sprague is a Chief Wind Computational Scientist and Distinguished Member of Research Staff at the National Renewable Energy Laboratory (NREL) near Boulder, Colorado. Over the last seven years, Mike has been Principal Investigator for several U.S. Department of Energy (DOE) supported projects in high-fidelity modeling and high-performance computing for wind energy, including ExaWind, which is part of the DOE Exascale Computing Project. Mike is currently Director of the DOE Office of Science FLOWMAS Energy Earthshot Research Center. Before coming to NREL in 2010, Dr. Sprague was an assistant professor and founding faculty member in applied mathematics at the University of California, Merced. He graduated with a PhD in Mechanical Engineering from the University of Colorado at Boulder and Bachelor of Science degree from the University of Wisconsin-Madison.

Abstract:

The predictive simulation of the dynamics of modern wind turbines and wind farms is a high-performance-computing (HPC) grand challenge. Modern wind turbines are the largest rotating machines in the world, with rotor diameters exceeding 200 meters, and with heights reaching well into the atmospheric boundary layer. To address this grand challenge, the U.S. Department of Energy (DOE) Wind Energy Technologies Office and the DOE Exascale Computing Project have been supporting the creation of the ExaWind modeling and simulation environment since 2016. ExaWind is composed of the incompressible-flow computational-fluid-dynamics (CFD) solvers AMR-Wind and Nalu-Wind and the wind-turbine-dynamics solver OpenFAST. ExaWind codes have been developed with performance portability as a priority, with the first U.S. exascale computer, Frontier, being our target platform. Frontier relies on graphical processing units (GPUs) for acceleration, which presents a major challenge to

codes designed for CPUs. In this talk I will give a historical overview of the Exascale Computing Project, an eight-year $1.7 billion project. I will show results from our ExaWind challenge problem on Frontier and describe the strong-scaling challenges. I will then describe the challenges of simulating floating offshore wind turbines and the FLOWMAS Energy Earthshot Research Center.

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