Boulder Fluid and Thermal Sciences Seminar Series

Tuesday, October 3, 2017
3:30pm-4:30pm (refreshments at 3:15pm)
Bechtel Collaboratory in the Discovery Learning Center (DLC)
University of Colorado, Boulder

The POD, reduced-order modeling, and control strategies for wind turbine wakes

Nicholas Hamilton, *National Renewable Energy Laboratory*

The proper orthogonal decomposition (POD) is among the most trusted tools in the analysis of turbulent fluid mechanics and is frequently employed to identify and isolate dynamically significant features underlying a given flow. The spatially coherent turbulence structures that form the POD modal basis are ordered according to the energy they represent in the full turbulence field, and may be used to filter turbulent flow data or model a flow with only the large-scale dynamics. Herein, the POD is employed as the basis for a reduced-order modeling technique tested on the canonical turbulent channel flow. Afterward, a computationally efficient model for a wind turbine wake (wakeROM) defined through turbulent velocity fields from large-eddy simulation data. The wakeROM is defined by inter-relating dynamic mode coefficients through a series of polynomial parameters and the resulting system of ordinary differential equations models the dynamics of the wind turbine wake using only large-scale turbulence.

Biography: Nicholas Hamilton is a Research Engineer at the National Wind Technology Center, part of the National Renewable Energy Laboratory, where he focuses in field observations and validation of the next generation of wind plant design and operational tools. Nicholas participated in the International Masters of Science dedicated to computational and experimental turbulence in the cities of Lille and Poitiers, France. He comes to the Boulder area from Portland, Oregon, where he completed his PhD in mechanical engineering with focus in wind turbine wake dynamics, modal decomposition methods, and reduced-order modeling.