COLLEGE OF ENGINEERING & APPLIED SCIENCE

UNIVERSITY OF WYOMING

Friday

February 9

3:10 pm

EN 1045

Committee:

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Department of Mechanical Engineering

Doctoral Final Examination Oral

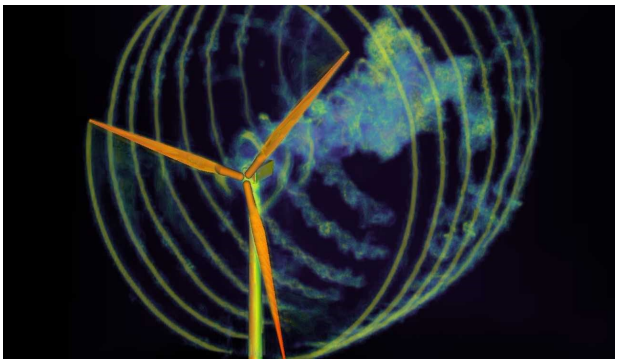
Enabling High-Order Methods for Extreme-Scale Simulations

Andrew C. Kirby

3:10 pm **February 9, 2018** **EN 1045**

ABSTRACT:
With the continued growth of computational resources, the development of high-order methods for computational fluid dynamics (CFD) has become an important track for obtaining high performance on new computer architectures and obtaining high-fidelity solutions. This work advances the discontinuous Galerkin (DG) method for extreme-scale simulation through the development of a discretization that is robust, highly computationally efficient, highly parallel scalable, and suitable for simulation of multiscale problems.

For simulation of fluid dynamics problems containing complex geometries, the development and instrumentation of the DG method into a larger computational framework employing a multi-solver, multi-mesh paradigm with overlapping grids is pursued. The computational framework instruments a *near-body*, *off-body* mesh system through a dynamic overset framework. The near-body mesh uses unstructured grid technologies to accurately capture detailed geometries of the bodies of study, and the off-body mesh is responsible for capturing unsteady turbulent features using dynamic adaptive structured grids.



Blade-resolved simulations of wind energy applications are presented. Simulations of individual wind turbines are studied for accurate prediction and for learned simulation strategies to simulate full wind farms incorporating up to 100 wind turbines.

BIOGRAPHY:
Andrew is a fifth-year Ph.D. student under the direction of Professor Dimitri Mavriplis. He is a 2016-2017 Blue Waters Graduate Fellow. Andrew obtained his Bachelors of Science in Mathematics from the University of Wisconsin-Madison in 2011 and his Masters of Science in Applied Mathematics from Columbia University in 2013.