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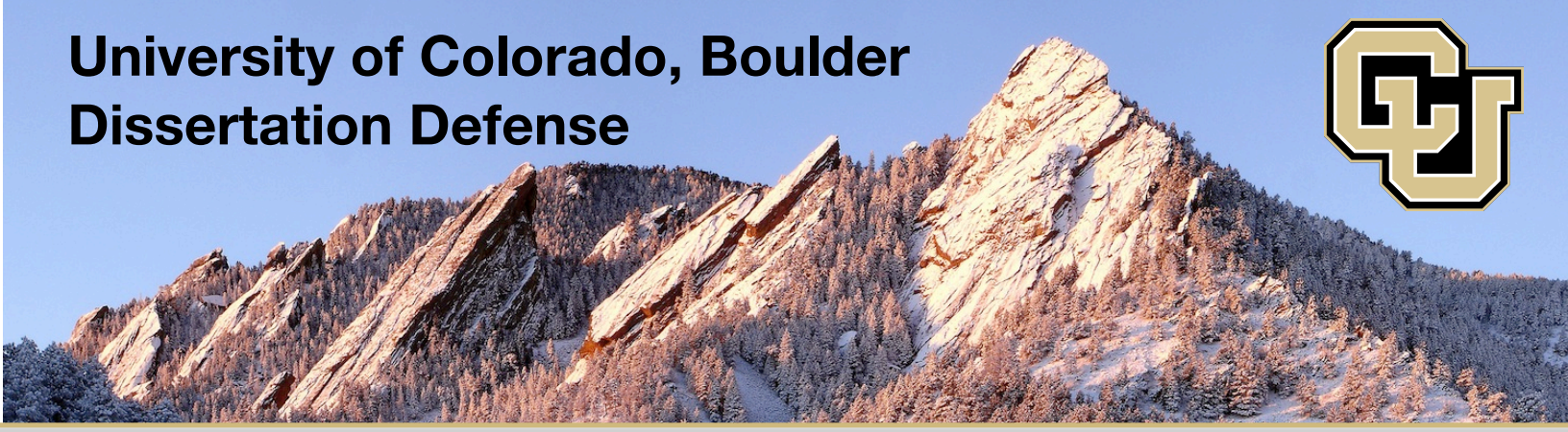

Tuesday, August 16, 2016
10:00am-11:00am (refreshments at 9:45am)
Bechtel Collaboratory in the Discovery Learning Center (DLC)
University of Colorado, Boulder

Learning and Optimization for Turbulent Flows

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Turbulence is pervasive throughout most thermal-fluid systems, yet the modeling of turbulence and its effects on engineering systems remain a persistent challenge. This dissertation brings a new set of analytical tools to bear on the turbulence problem, and in doing so reveals new insights about turbulence modeling and engineering design optimization. Data-driven machine learning and optimization techniques are employed in a new autonomic closure for coarse-grained turbulent flow simulations. Sparsity-inducing, multi-task learning, feature extraction, and kernel-based extensions of the autonomic closure are further explored. These techniques improve the speed, accuracy, and interpretability of the autonomic closure. Additionally, efficient adjoint optimization techniques are used to improve the design of wind farm layouts. This novel application of adjoint optimization brings groundbreaking model fidelity and high-dimensional gradient-based optimization algorithms to the challenging turbulent flow control problem found in designing wind farms. In both applications, the optimization and learning framework provides new insights into turbulence modeling and applied engineering design.

Biography: Ryan King was born and raised in Sacramento, CA and completed a Bachelor of Science in Mechanical Engineering at the Massachusetts Institute of Technology in 2009. After graduating from MIT, he worked for RES Americas, a wind energy developer in Colorado. At RES, Ryan was involved in the design and construction of over 750 MW of wind energy now operating across North America. In 2012, Ryan joined the Wind Energy Systems Engineering group at the National Renewable Energy Laboratory, and began his PhD studies in the Mechanical Engineering Department at CU Boulder. This Fall, Ryan will join NREL's Computational Science Center.