Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Wind Farm LES Simulations Using an Overset Methodology[1]
SHREYAS ANANTHAN, SHASHANK YELLAPANTULA, NREL, Golden — Accurate simulation of wind farm wakes under realistic atmospheric inflow conditions and complex terrain requires modeling a wide range of length and time scales. The computational domain can span several kilometers while requiring mesh resolutions in $O(10^{-6})$ to adequately resolve the boundary layer on the blade surface. Overset mesh methodology offers an attractive option to address the disparate range of length scales; it allows embedding body-confirming meshes around turbine geomtries within nested wake capturing meshes of varying resolutions necessary to accurately model the inflow turbulence and the resulting wake structures. Dynamic overset hole-cutting algorithms permit relative mesh motion that allow this nested mesh structure to track unsteady inflow direction changes, turbine control changes (yaw and pitch), and wake propagation. An LES model with overset mesh for localized mesh refinement is used to analyze wind farm wakes and performance and compared with local mesh refinements using non-conformal (hanging node) unstructured meshes. Turbine structures will be modeled using both actuator line approaches and fully-resolved structures to test the efficacy of overset methods for wind farm applications.

[1]Exascale Computing Project (ECP), Project Number: 17-SC-20-SC, a collaborative effort of two DOE organizations the Office of Science and the National Nuclear Security Administration

Shreyas Ananthan
NREL, Golden

Date submitted: 01 Aug 2017 Electronic form version 1.4