Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Actuator-line simulations of wind turbines with block-structured adaptive mesh refinement[1] MAHESH NATARAJAN[2], HARISWARAN SITARAMAN[3], SHREYAS ANANTHAN[4], MICHAEL ALAN SPRAGUE[5], National Renewable Energy Laboratory — Wind turbine parametrization methods such as the actuator disk (ADM) or actuator line methods (ALM) have shown good promise in determining power generation and loads on the turbine blades. However, performing such simulations in a cost-effective manner is a challenging task, due to the wide range of scales involved. The scales in the atmospheric boundary layer (ABL) range from 1 km to scales in the wake region that are 1 m. Adaptive mesh refinement techniques are well suited for this scenario, and will enable well-resolved simulations that can capture turbulent structures across multiple length scales. In this work, we implement an ALM model in two frameworks - a compressible and an incompressible flow solver - both developed within the block-structured adaptive mesh refinement (AMR) framework of AMReX [1], and compare their performance. Computational scaling studies are done on a single turbine configuration, and compared with Nalu-Wind [2] - an unstructured CFD solver for wind turbine simulations.

[1]This work was funded by the U.S. Department of Energy under Contract No. DE-AC36-08-GO28308 with the National Renewable Energy Laboratory.
[2]Researcher II - Computational Science
[3]Researcher IV - Mechanical Engineering
[4]Researcher V - Software Engineering
[5]Researcher VI - Computational Science

Mahesh Natarajan
National Renewable Energy Laboratory

Date submitted: 01 Aug 2019 Electronic form version 1.4