Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Reduced-order FSI simulation of NREL 5 MW wind turbine in atmospheric boundary layer turbulence JAVIER MOTTA-MENA, ROBERT CAMPBELL, ADAM LAVELY, PANKAJ JHA, Pennsylvania State University — A partitioned fluid-structure interaction (FSI) solver based on an actuator-line method solver and a finite-element modal-dynamic structural solver is used to evaluate the effect of blade deformation in the presence of a day-time, moderately convective atmospheric boundary layer (ABL). The solver components were validated separately and the integrated solver was partially validated against FAST. An overview of the solver is provided in addition to results of the validation study. A finite element model of the NREL 5 MW rotor was developed for use in the present simulations. The effect of blade pitching moment and the inherent bend/twist coupling of the rotor blades are assessed for both uniform inflow and the ABL turbulence cases. The results suggest that blade twisting in response to pitching moment and the bend/twist coupling can have a significant impact on rotor out-of-plane bending moment and power generated for both the uniform inflow and the ABL turbulence cases.

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Date submitted: 31 Jul 2015 Electronic form version 1.4