Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Numerical simulations with a FSI-calibrated actuator disk model of wind turbines operating in stratified ABLs S. M. IMAN GOHARI, Ph.D. candidate , SUTANU SARKAR, Professor, ARTEM KOROBENKO , Assistant professor , YURI BAZILEVS, Professor — Numerical simulations of wind turbines operating under different regimes of stability are performed using LES. A reduced model, based on the generalized actuator disk model (ADM), is implemented to represent the wind turbines within the ABL. Data from the fluid-solid interaction (FSI) simulations of wind turbines have been used to calibrate and validate the reduced model. The computational cost of this method to include wind turbines is affordable and incurs an overhead as low as 1.45%. Using this reduced model, we study the coupling of unsteady turbulent flow with the wind turbine under different ABL conditions: (i) A neutral ABL with zero heat-flux and inversion layer at 350m, in which the incoming wind has the maximum mean shear between the heights of upper-tip and lower-tip; (2) A shallow ABL with surface cooling rate of -1 K/hr wherein the low level jet occurs at the wind turbine hub height. We will discuss how the differences in the unsteady flow between the two ABL regimes impact the wind turbine performance.

S. M. Iman Gohari
Ph.D. candidate

Date submitted: 31 Jul 2017 Electronic form version 1.4