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Toward Affordable, Theory-and-Simulation-Inspired, Models for Realistic Wind Turbine Aerodynamics and Noise FOLUSO LADEINDE, Stony Brook University, Stony Brook, NY 11794-2300 USA, KEN ALABI, WEN-HAI LI, TTC Technologies, Inc., Centereach, NY 11720 USA — The problem of generating design data for the operation of a farm of wind turbines for clean energy production is quite complicated, if properly done. Potential flow theories provide some models, but these are not suitable for the massive aerodynamic separation and turbulence that characterize many realistic wind turbine applications. Procedures, such as computational fluid dynamics (CFD), which can potentially resolve some of the accuracy problems with the purely theoretical approach, are quite expensive to use, and often prohibit real-time design and control. In our work, we seek affordable and acceptably-accurate models derived from the foregoing approaches. The simulation used in our study is based on high-fidelity CFD, meaning that we use high-order (compact-scheme based), mostly large-eddy simulation methods, with due regards for the proper treatment of the stochastic inflow turbulence data. Progress on the project described herein will be presented.

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