The 10th TSME International Conference on Mechanical Engineering
10th – 13rd December 2019
Pattaya, Thailand

Computational Aerodynamics Modeling of a 5MW NREL Wind Turbine

Auraluck Pichitkul[1*], and Lakshmi N. Sankar[1]

[1]School of Aerospace Engineering, Georgia Institute of Technology, Atlanta, 30332, United States of America

* Corresponding Author: apichitkul3@gatech.edu

Abstract. Aerodynamic performance of a large-scale 5 MW offshore wind turbine rotor designed by National Renewable Energy Laboratory (NREL) is investigated numerically using a hybrid Navier-Stokes/free wake method. This method simulates the flow over wind turbine rotor blade in the near-field region using RANS technique while models the rotor blade wake located far field by a Lagrangian wake representation. The results obtained from hybrid methodology at design condition show a good agreement with predictions from the blade element momentum theory and more computationally expensive wake-capturing simulations. In addition, a new offshore wind turbine of the same rating as NREL turbine has been created based purely on aerodynamic considerations. The performance of the two wind turbines are compared to assess the efficacy of different design approaches.

Keywords: Offshore Wind Turbine, Renewable Energy, Aerodynamics, Computational Fluid Dynamics