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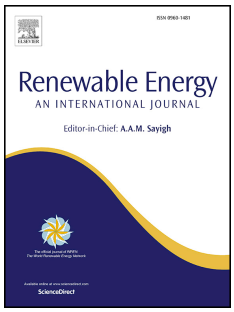

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Noise Reduction of a Horizontal Wind Turbine using Different Blade Shapes

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Abstract

Investigation of blade tip shape effect on the noise emission from horizontal axis wind turbine is the target of this work. To recognize the flow around blade wind turbine, and to minimize the noise emission especially at the tip; three different tip blade configurations are tested by using the aerodynamic and the aero-acoustic computational methods. Three dimensional flow simulations are carried out with two unsteady CFD simulations; Unsteady Reynolds-averaged Naviere-Stokes (URANS) and Detached Eddy Simulation (DES). These methods are used to calculate the near-field flow around a HAWT of NREL Phase VI small scale model with different tip blade shapes. Ffowcs Williams-Hawkings (FW–H) analogy is used to predict the sound generated from the turbine, and then it is validated and compared with available experimental data for small-scaled model of NREL Phase VI. In general, the comparison confirms a good and acceptable agreement between DES results and the experimental measured noise results. Moreover, it is shown that a possibility to reduce or minimize the sound pressure level by using a specific tip shape. The results indicated that the usage of a specific tip shape has an important and significant influence on the noise emission in particular at the high frequency range.

Keywords: Wind turbine noise, Aerodynamics, DES, URANS Simulation, Acoustic analogy Tip blade shape.

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