

VELOCITY INTERFERENCE IN THE REAR ROTOR OF A COUNTER-ROTATING WIND TURBINE

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A counter-rotating wind turbine having two rotors rotating in opposite directions on the same axis has been proposed to improve the aerodynamic performance of a wind turbine. In order to predict the aerodynamic performance of the counter-rotating wind turbine, the inflow interference in its rear rotor needs to be considered because the rear rotor operates inside the wake of the front rotor. In the previous research [1], operation of the rear rotor inside the fully developed stream tube of the front rotor has been assumed to define the inflow condition of the rear rotor. In this study, in order to improve the inflow model for the rear rotor, the aerodynamic analysis of the counter-rotating wind turbine is carried out by using a vortex lattice method. The induction factors near the region for the rear rotor are calculated with variations of the thrust of each rotor and the distance from the front rotor. Based on the results, the inflow model for the rear rotor is newly proposed and is applied to the blade element-momentum theory for the aerodynamic optimization of the counter-rotating wind turbine.

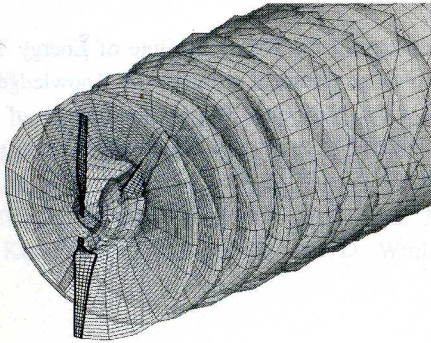


Figure 1. Wake of the counter-rotating wind turbine

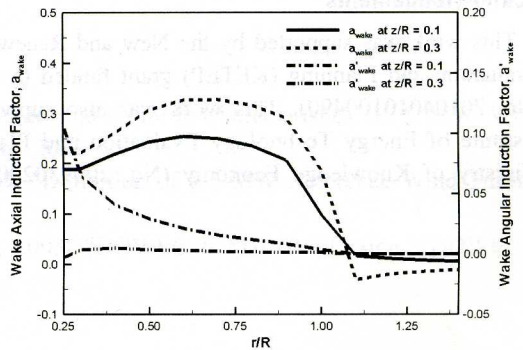


Figure 2. Wake induction factors at $z/R=0.1$ & 0.3

References

- [1] Seungmin Lee, Hogeon Kim, Soogab Lee, "Effect of design parameters on aerodynamic performance of a counter-rotating wind turbine", ISLCT2010, 15-18, Nov., 2010, Jeju, Korea, S339-S342

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