

عنوان مقاله:

Numerical Study of the Wake Flow of a Wind Turbine with Consideration of the Inflow Turbulence

محل انتشار:

ژورنال مهندسی عمران، دوره 4، شماره 8 (سال: 1397)

تعداد صفحات اصل مقاله: 10

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خلاصه مقاله:

Considering the fact that wind turbines operate at the bottom of the atmospheric boundary layer (ABL) where the turbulence is at a high level, and the difficulty of mesh generation in the fully modeled numerical simulation, it is necessary to carry out researches to study the wake flow of wind turbines with consideration of the inflow turbulence. Therefore, a numerical method generating turbulence was proposed and the results show good agreement with those in experiments, based on which the flow fields in the wake of a wind turbine at two tip speed ratios are examined in detail through three actuator methods, namely, ADM, ADM-R and ALM. The performances of these methods were studied and the error sources for each method are clarified. Moreover, the computational efficiency were revealed and the influencing factor for the efficiency is concluded. Besides, the equilibrium relation of the N-S equation in the wake is revealed, which provides a theoretical basis for the optimal arrangement of the wind turbine. It shows that the mean velocity and fluctuating velocity vary greatly near the wind turbine, and become stable gradually away from the wind turbine. The results of ALM method shows the best agreement with the experiment. At near wake region, the turbulent stress term, pressure gradient term and convection term mainly contribute to the equation equilibrium, and convection term is in equilibrium with the turbulent stress term at the far wake.

کلمات کلیدی:

Actuator Disk; Actuating Line; Wind Turbines Wake; CFD; Numerical Simulation

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