عنوان مقاله:

Kelvin Waves Structure Analysis of a Horizontal Axis Wind Turbine Tip Vortices

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خلاصه مقاله:

The optimization of the wind energy conversion is one of the most important domains which was widely interested researchers. The instabilities in the wind turbine wake are one of the sources of energy loss which strongly influenced the helical tube vortex structure and are generally difficult to be quantified using experimental facilities. This paper presents a numerical investigation on the wake downstream of a horizontal axis wind turbine (HAWT) model using the Fluent software. Results were validated using experimental measurements conducted in the CRTEn wind tunnel. The Kelvin wave's theory was, also, used to analyze the deformations acting on the tip vortices. The cartography of the velocity gradient tensor components of the first tip vortex and the different families of Kelvin wave's were studied and classified according to the azimuth wavenumber. The obtained results confirm that the tip vortices meandering correspond to the helical mode of Kelvin wave's and the stretching-compression phenomenon is the most important deformation acting on the tip vortex tubes during the development of HAWT wake.

کلمات کلیدی:

dimensional wake, Horizontal axis wind turbine, Kelvin waves, Three, velocity gradient tensor, Stretching, Flow separation, Compression