عنوان مقاله:

Performance improvement of a wind turbine blade using a developed inverse design method

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خلاصه مقاله:

The purpose of this study is to improve the aerodynamic performance of wind turbine blades, using the Ball-Spine inverse design method. The inverse design goal is to calculate a geometry corresponds to a given pressure distribution on its boundaries. By calculating the difference between the current and target pressure distributions, geometric boundaries are modified so that the pressure difference becomes negligible and the target geometry can be obtained. In this paper, The Ball-Spine inverse design algorithm as a shape modification algorithm is incorporated into CFX flow solver to optimize a wind turbine airfoil. First, the presented inverse design method is validated for a symmetric airfoil in viscous incompressible external flows. Then, the pressure distribution of the asymmetric airfoil of a horizontal wind turbine is modified in such a way that its loading coefficient increases. The lift coefficient and lift to drag ratio for the new modified airfoil get 5% and 3.8% larger than that of the original airfoil. The improved airfoil is substituted by the original airfoil, respectively. in the wind turbine. Finally, the aerodynamic performance of the new wind turbine is calculated by 3-D numerical simulation. The results show that the power factor of the new optimized wind turbine is about 3.2% larger than that of the original one.

کلمات کلیدی:

ANSYS CFX, Improved Aerodynamics, Inverse Design, Wind Turbine Airfoil