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Influence of Geometrical Parameters of a Wind Turbine on the Optimal Tip-Speed Ratio

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Abstract : The paper describes the geometric model, calculation algorithm and results of the CFD simulation of the airflow around a rotor in the vertical axis wind turbine (VAWT) with the ANSYS Fluent computational solver. The CFD method enables creating aerodynamic characteristics of forces acting on rotor working surfaces and determining parameters such as torque or power generated by the rotor assembly. The object of the research was a rotor whose construction is based on patent no.PL219985. The conducted tests enabled a mathematical model with a description of the generation of aerodynamic forces acting on each rotor blade. Additionally, this model was compared to the results of the wind tunnel tests. The analysis also focused on the influence of the blade angle on turbine power and the TSR. The research has shown that the turbine blade angle has a significant impact on the optimal value of the TSR.

Keywords : computational fluid dynamics, numerical analysis, renewable energy, wind turbine
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