

CFD Simulation Research on a Double Diffuser for Wind Turbines

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Abstract : Wind power is based on a variety of construction solutions to convert wind energy into electrical energy. These constructions are constrained by the correlation between their energy conversion efficiency and the area they occupy. Their energy conversion efficiency can be improved by wind tunnel tests of a rotor as a diffuser to optimize shapes of aerodynamic elements, to adapt these elements to changing conditions and to increase airflow intensity. This paper discusses the results of computer simulations and aerodynamic analyzes of this innovative diffuser design. The research aims at determining the aerodynamic phenomena triggered by the airflow inside this construction, and developing a design to improve the efficiency of the wind turbine. The research results enable us to design a diffuser with a double Venturi nozzle and specially shaped blades. The design of this type uses Bernoulli's law on the behavior of the flowing medium in the tunnel of a decreasing diameter. The air flowing along the tunnel changes its velocity so the rotor inside such a decreased tunnel diameter rotates faster in this airflow than does the wind outside this tunnel, which makes the turbine more efficient. Additionally, airflow velocity is improved by applying aerodynamic rings with extended trailing edges to achieve controlled turbulent vortices.

Keywords : wind turbine, renewable energy, cfd, numerical analysis

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