Estimating the Effect of Rotor Diameter on the Physical Properties of NACA0015 Airfoil-Based Vertical-Axis Wind Turbine

This study combines aerodynamic and structural analyses on a vertical-axis wind turbine (VAWT) built using NACA0015 airfoil-based blades. Aerodynamic analyses consist of velocity and pressure profiles as well as the drag behaviour. Structural investigations have included stress and displacement of the blade to the airflow pressure. This study has highlighted the effect of the diameter variation on VAWT physical performance. The results have showed a positive effect of the rotor diameter on the laminar flow and Von Karman vortex street. The drag coefficient behaviour was reduced with the diameter increase due to the reduction of the wake within the thin layers of the laminar behind the streamlined airfoils. Also, the structural stress and displacement were negatively affected by the diameter increase.