

Vortex generators application for reduction of boundary layer separation on wind turbine blades

Although the first attempts to generate electricity using wind turbines date back to the late nineteenth century, it would not be until the late twentieth century that wind energy has been seen as one of the most promising solutions to man's ever increasing demands of energy. In order to keep it economically competitive with traditional and other renewable energy sources, wind turbine and rotor size has been continuously increasing. However, large rotors present non-uniform inflow conditions along the span, which if left uncontrolled, lead to increased flow separation. As a consequence of the flow separation, the blade presents increased aerodynamic losses, noise generation and fatigue loads. Diverse flow control devices have been developed in the last few decades in order to mitigate flow separation. Among them, it is possible to find the vortex generators (VGs). These are designed to create streamwise vorticity along the blade surface, which transports high momentum fluid from zones in the upper part of boundary layer near the surface, resulting in a less prone to separation profile.

The research work carried out dealt with the issue of numerical analysis of the flow around wind turbine blades and the possibility of aerodynamic enhancement by application of a new type of vortex generator, rod vortex generators (RVGs). Due to the complexity of the problem, it was divided into simpler cases to be studied prior to the simulation of a full rotor with vortex generators. These simpler cases, and the analysis of a full wind turbine rotor with the implemented technology, would be presented during the seminar.