

Computational study on the aerodynamic performance of wind turbine airfoil fitted with Coanda jet

ABSTRACT

Various methods of flow control for enhanced aerodynamic performance have been developed and applied to enhance and control the behavior of aerodynamic components. The use of Coandă effect for the enhancement of circulation and lift has gained renewed interest, in particular with the progress of CFD. The present work addresses the influence, effectiveness, and configuration of Coandă-jet fitted aerodynamic surface for improving lift and C_p , specifically for S809 airfoil, with a view on its incorporation in the wind turbine. A simple two-dimensional CFD modeling using $k-\epsilon$ turbulence model is utilized to reveal the key elements that could exhibit the desired performance for a series of S809 airfoil configurations. Parametric study performed indicates that the use of Coandă-jet S809 airfoil can only be effective in certain range of trailing edge rounding-off radius, Coandă-jet thickness, and momentum jet size. The location of the Coandă-jet was found to be effective when it is placed close to the trailing edge. The results are compared with experimental data for benchmarking. Three-dimensional configurations are synthesized using certain acceptable assumptions. A trade-off study on the S809 Coandă configured airfoil is needed to judge the optimum configuration of Coandă-jet fitted Wind-Turbine design.

Keyword: Coandă effect; Wind turbine; Computational; Aerodynamic performance; Aerodynamic components; Coanda-jet