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Large-Eddy Simulations of Plasma Flow Control on a GOE735 Wind Turbine Airfoil ALEXANDER CZULAK, Robert Bosch LLC, JENNIFER FRANCK, Brown University — Active flow control using plasma actuation was studied for the GOE735 airfoil and compared to non-actuated baseline cases using numerical simulations. This investigation considers two-dimensional simulations at a Reynolds number of 1,000 using direct numerical simulation (DNS) as well as three-dimensional simulations at a Reynolds number of 50,000 and 100,000 using large-eddy simulation (LES). Plasma actuation is applied in terms of a source term within the boundary layer close to the airfoil surface. Angles of attack of 0°, 5° and 15° were considered, and control is shown to be effective at increasing the lift coefficient, decreasing the drag coefficient and reducing the root mean squared deviation of both lift and drag. An analysis of the flow physics reveals that the actuated cases delay the point of separation, reduce the wake width and diminish the size and strength of the shed vortices. For this particular airfoil, there are significant differences in Reynolds number in terms of the baseline flow, control effectiveness and performance factors such as lift and drag.

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