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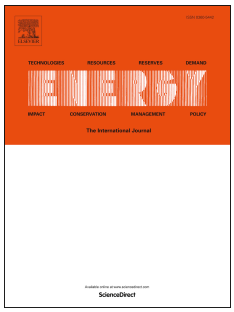

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DDES with Adaptive Coefficient for Stalled Flows past a Wind Turbine Airfoil

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Abstract A new delayed detached eddy simulation method with adaptive coefficient (DDES-AC) is proposed to overcome the transition delay from Reynolds-averaged Navier–Stokes (RANS) to large eddy simulation (LES) in the simulation of the mild, moderate separation, and dynamic stall flows past a wind turbine airfoil (NACA0015). The coefficient C_{DES} is designed to be adaptive with the flow patterns, quasi-2D or 3D vortex structures, which aids in reducing the modelled eddy viscosity in the initial region of the separated shear layer. The DDES-AC is proved to be effective in the simulation of a fully attached plate flow without additional skin friction loss and a NACA0015 airfoil with a mild trailing edge separation. It also outperforms the DDES in moderate separation at an angle of attack beyond the static stall. The DDES presents “delay behaviour” in the dynamic stall simulation, resulting in an underestimation of the drag and pitching moment peaks and a deferred recovery of those in the downstroke. However, the DDES-AC improves the prediction accuracy and agrees excellently with the available experiment data.

Keywords: Delayed detached eddy simulation, Adaptive coefficient, Wind turbine airfoil, Separation, Dynamic stall

Nomenclature

AoA	=	Angle of attack
C	=	Chord length

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