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New hybrid turbulence modelling approach, with application to dynamic stall control SIGFRIED HAERING, ROBERT MOSER, University of Texas at Austin — We present numerical studies of a stalled airfoil experiencing transitory flow control using a new hybrid RANS/LES modeling approach developed specifically for such challenging flow scenarios. Traditional hybrid approaches exhibit deficiencies when used for fluctuating smooth-wall separation and reattachment necessitating ad-hoc delaying functions and model tuning making them no longer useful as a predictive tool. Additionally, complex geometries and flows often require high cell aspect-ratios and large grid gradients as a compromise between resolution and cost. Such transitions and inconsistencies in resolution detrimentally effect the fidelity of the simulation. Our approach more naturally transitions between RANS to LES obviating the need for tuning and directly accounts for anisotropy and inhomogeneity in the flow and grid. The results of these simulations not only provide fundamental insight into experimentally observed stall control mechanisms but also display the versatility and accuracy of the new modeling method in simulating complex flow phenomena.

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