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Wall Modeled Large Eddy Simulation of Airfoil Trailing Edge Noise[1] JOSEPH KOCHEEMOOLAYIL, SANJIVA LELE, Stanford Univ — Large eddy simulation (LES) of airfoil trailing edge noise has largely been restricted to low Reynolds numbers due to prohibitive computational cost. Wall modeled LES (WMLES) is a computationally cheaper alternative that makes full-scale Reynolds numbers relevant to large wind turbines accessible. A systematic investigation of trailing edge noise prediction using WMLES is conducted. Detailed comparisons are made with experimental data. The stress boundary condition from a wall model does not constrain the fluctuating velocity to vanish at the wall. This limitation has profound implications for trailing edge noise prediction. The simulation over-predicts the intensity of fluctuating wall pressure and far-field noise. An improved wall model formulation that minimizes the over-prediction of fluctuating wall pressure is proposed and carefully validated. The flow configurations chosen for the study are from the workshop on benchmark problems for airframe noise computations. The large eddy simulation database is used to examine the adequacy of scaling laws that quantify the dependence of trailing edge noise on Mach number, Reynolds number and angle of attack. Simplifying assumptions invoked in engineering approaches towards predicting trailing edge noise are critically evaluated.

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