

Abstract Submitted
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Large Eddy Simulation of Airfoil Self-Noise at High Reynolds Number¹ JOSEPH KOCHEEMOOLAYIL, SANJIVA LELE, Stanford University — The trailing edge noise section (Category 1) of the Benchmark Problems for Airframe Noise Computations (BANC) workshop features five canonical problems. No first-principles based approach free of empiricism and tunable coefficients has successfully predicted trailing edge noise for the five configurations to date. Our simulations predict trailing edge noise accurately for all five configurations. The simulation database is described in detail, highlighting efforts undertaken to validate the results through systematic comparison with dedicated experiments and establish insensitivity to grid resolution, domain size, alleatory uncertainties such as the tripping mechanism used to force transition to turbulence and epistemic uncertainties such as models for unresolved near-wall turbulence. Ongoing efforts to extend the predictive capability to non-canonical configurations featuring flow separation are summarized. A novel, large-span calculation that predicts the flow past a wind turbine airfoil in deep stall with unprecedented accuracy is presented. The simulations predict airfoil noise in the near-stall regime accurately. While the post-stall noise predictions leave room for improvement, significant uncertainties in the experiment might preclude a fair comparison in this regime.

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