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Direct numerical simulation of broadband trailing edge noise from a NACA 0012 airfoil[1] MOHAMMAD MEHRABADI, DANIEL BODONY, University of Illinois at Urbana-Champaign — Commercial jet-powered aircraft produce unwanted noise at takeoff and landing when they are close to near-airport communities. Modern high-bypass-ratio turbofan engines have reduced jet exhaust noise sufficiently such that noise from the main fan is now significant. In preparation for a large-eddy simulation of the NASA/GE Source Diagnostic Test Fan, we study the broadband noise due to the turbulent flow on a NACA 0012 airfoil at zero degree angle-of-attack, a chord-based Reynolds number of 408,000 and a Mach number of 0.115 using direct numerical simulation (DNS) and wall-modeled large-eddy simulation (WMLES). The flow conditions correspond to existing experimental data. We investigate the roughness-induced transition-to-turbulence and sound generation from a DNS perspective as well as examine how these two features are captured by a wall model. Comparisons between the DNS- and WMLES-predicted noise are made and provide guidance on the use of WMLES for broadband fan noise prediction.

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