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Hybrid Analysis of Engine Core Noise JEFFREY O'BRIEN, JEONGLAE KIM, MATTHIAS IHME, Stanford University - Center for Turbulence Research — Core noise, or the noise generated within an aircraft engine, is becoming an increasing concern for the aviation industry as other noise sources are progressively reduced. The prediction of core noise generation and propagation is especially challenging for computationalists since it involves extensive multiphysics including chemical reaction and moving blades in addition to the aerothermochemical effects of heated jets. In this work, a representative engine flow path is constructed using experimentally verified geometries to simulate the physics of core noise. A combustor, single-stage turbine, nozzle and jet are modeled in separate calculations using appropriate high fidelity techniques including LES, actuator disk theory and Ffowcs-Williams Hawkings surfaces. A one way coupling procedure is developed for passing fluctuations downstream through the flowpath. This method effectively isolates the core noise from other acoustic sources, enables straightforward study of the interaction between core noise and jet exhaust, and allows for simple distinction between direct and indirect noise. The impact of core noise on the farfield jet acoustics is studied extensively and the relative efficiency of different disturbance types and shapes is examined in detail.

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