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**Engine core noise analysis using an hybrid modeling approach**

JEFFREY O'BRIEN, JEONGLAE KIM, MATTHIAS IHME, Stanford University - Center for Turbulence Research — As aircraft engines become progressively quieter through the reduction of jet noise, the acoustic contributions of components upstream of the jet, especially the combustor, must be reduced to produce still quieter engines. Combustion noise can be broken down into two components: direct and indirect noise. Direct noise refers to pressure fluctuations that are generated directly by turbulent combustion, while indirect noise describes acoustics that stem from the interaction between the entropy fluctuations generated inside a combustor and the downstream flow path. This study analyzes the effects of both types of core noise. An LES simulation of a model swirl combustor is performed in order to generate representative pressure and entropy fluctuations which are then fed into a moving-mesh RANS calculation of a high pressure turbine stage. The evolution of these fluctuations through the turbine stage is analyzed and the "chopping" effect of the turbine on the fluctuations is characterized. Additionally, the turbine output will be fed into a fully compressible jet noise calculation to assess how the entropy fluctuations are affected by the flow path and alter the acoustic behavior of the jet.

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