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On core noise for the typical operating conditions in a realistic gas turbine combustor CHANGXIAO SHAO, KAZUKI MAEDA, MATTHIAS IHME, Stanford University, MATTHIAS IHME TEAM — Commercial aircraft will continue to transport our society for decades to come. However, engine noise is one of the major issues because it adversely affects human's health and constrains air traffic growth. Engine-core noise consists of two distinct mechanisms, namely direct and indirect noise. Direct combustion noise describes the transmission of pressure fluctuations originating from unsteady heat-release in the combustion chamber. In contrast, indirect combustion noise is caused by the convection of unsteady vortices and entropy variations by temperature hot spots as they propagate from the combustor to the downstream turbine and nozzle. More recently, contributions from mixture inhomogeneities were identified as an additional source for indirect combustion noise that can interact and even exceed entropy noise. The relative contributions of these noise-source mechanisms are strongly dependent on the operating conditions, engine type, and interaction with other noise-source mechanisms. Core noise from a realistic gas-turbine combustor is investigated using a hybrid large-eddy simulation/linearized Euler equation (LES/LEE) framework. The effect of operating conditions on the relative noise-source contributions arising from direct and indirect noise are examined by considering cruise and takeoff conditions. The present work can help with the identification and quantification of the generation, transmission, and conversion of combustion noise.

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