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Simulation and stability analysis of supersonic impinging jet noise with microjet control[1] NATHANIEL HILDEBRAND, JOSEPH W. NICHOLS, Univ of Minn - Minneapolis — A model for an ideally expanded 1.5 Mach turbulent jet impinging on a flat plate using unstructured high-fidelity large eddy simulations (LES) and hydrodynamic stability analysis is presented. Note the LES configuration conforms exactly to experiments performed at the STOVL supersonic jet facility of the Florida Center for Advanced Aero-Propulsion allowing validation against experimental measurements. The LES are repeated for different nozzle-wall separation distances as well as with and without the addition of sixteen microjets positioned uniformly around the nozzle lip. For some nozzle-wall distances, but not all, the microjets result in substantial noise reduction. Observations of substantial noise reduction are associated with a relative absence of large-scale coherent vortices in the jet shear layer. To better understand and predict the effectiveness of microjet noise control, the application of global stability analysis about LES mean fields is used to extract axisymmetric and helical instability modes connected to the complex interplay between the coherent vortices, shocks, and acoustic feedback.

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