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Large-eddy simulation of compressible flow over a backward-facing step using a spectral multidomain method HARISH KANCHI, University of Illinois at Chicago, KAUSTAV SENGUPTA, Boeing Research and Technology-India, GUSTAAF JACOBS, San Diego State University, FARZAD MASHAYEK, University of Illinois at Chicago — Analysis of compressibility effects on separated curved shear layers in practical configurations has received little attention in the turbulence community. In this work, we perform large-eddy simulation (LES) of cold flow in an asymmetric dump-combustor with a spectral multi-domain method. The LES method combines a high-order multi-domain approximation with a dynamic sub-grid model and explicit interpolant-projection filtering to facilitate simulation at high Reynolds numbers. The inflow turbulence is modeled using a novel stochastic model, which is both efficient and general. We investigate the impact of the important physical parameters, such as the state of the boundary layer at separation, Reynolds number and Mach number as well as the interplay between them. One of the principal findings is the different responses of the transitional and turbulent shear layers with increase in compressibility. Increase in compressibility for the transitional flow causes a larger production of turbulent kinetic energy resulting in a faster growth of the shear layer. While for the turbulent shear layer, the growth rate is inhibited with increase in compressibility as a result of higher pressure-dilatation.

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