Abstract Submitted
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Enhancement of artificial bulk viscosity method for predicting sound and aero-optics in transonic regimes[1] PARVIZ MOIN, Stanford University, ALI MANI, JOHAN LARSEN, Stanford University — Alternative formulations of Cook and Cabot shock capturing model (Journal of Computational Physics, 2005) is investigated using large-eddy simulation (LES) of transonic flow over a cylinder at Re=10,000 and M=0.85. The original model uses an artificial bulk viscosity to adaptively thicken shocks over a few grid cells, and uses high order Laplacian of strain rate tensor magnitude to trigger the bulk viscosity coefficient. This model is employed in a 6th order staggered LES code on a structured mesh and found to cause unnecessary dissipation of dilatation in flow regimes other than shock regions. In particular, artificial viscosity magnitude was found to be an order of magnitude higher than physical viscosity in sound propagating regimes. Using derivatives of dilatation field as model's coefficient, instead of strain rate magnitude, is shown to significantly remove the unnecessary dissipation from the leading portion of the cylinder. Furthermore, employing a shock sensor switch to turn-off the model in the far-field is found to enhance prediction of flow generated noise. The impact of artificial dissipation on aero-optics will also be discussed.

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