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Large eddy simulations of the flow field of a radially lobed nozzle
NOUSHIN AMINI, Texas AM University, AARTHI SEKARAN, The University of Texas at Austin — Lobed nozzles have been a studied over the past couple of decades due to their enhanced mixing capabilities. Despite experimental (Hu et al, 2000) and numerical studies (Cooper et al, 2005), the nature of the jet is yet to be fully understood. This numerical study intends to carry out a thorough analysis of the flow field within and downstream of a six lobed nozzle. The study aims to confirm vortical interaction mechanisms and establish the role of hydrodynamic instabilities in the mixing process. This was inspired by a prior study by the authors wherein the same flow was studied using hot-wire anemometry. Although this helped obtain a qualitative idea of the flow, the 2D data was incapable of visualizing streamwise structures and the flow within the nozzle. Previous numerical simulations have used RANS and to simulate a single lobe of the nozzle; these results show some deficiencies in predicting the potential core length. Previous simulations done by authors indicated that RANS models qualitatively capture the flow structures but do not accurately represent the values of key parameters in the flow field. The present study aims to perform a 3D LES study of the flow field within and downstream of the nozzle to follow the ensuing free jet and thus analyze various mechanisms.

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