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Assessing grid resolution effects in large-eddy simulations of a jet-in-cross-flow[1] ANTHONY RUIZ, GUILHEM LACAZE, JOSEPH OEFELEIN, Sandia National Laboratories — Calculations using the Large Eddy Simulation technique are conducted over a range of resolutions in a Jet In Cross Flow. The configuration corresponds to the experiment of Su and Mungal (2004). A turbulent jet at a Reynolds Number of 5,000 is injected into a laminar cross flow, with a jet to cross-flow velocity ratio of 5.7. Resolutions are varied from typical engineering spatial and temporal resolutions to near-DNS resolution. The near-DNS resolution has been extensively validated against experimental results in a previous study [Ruiz et al., Phys. Fluid (2014)], which also focused on the evolution of the major scales of turbulence. The grid resolution is coarsened to investigate the impact on the topology of coherent structures and mixing. Fourier analysis is conducted at all resolutions to observe the impact of filtering on the turbulent energy cascade, identify the main hydrodynamic frequencies, and determine the degree to which these are grid-dependent. Once hydrodynamics modes are known, phase-locked analysis of the flow field shows the spatial structure of these modes as a function of resolution. This enables a clear understanding of the impact of resolution on the flow.

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Joseph Oefelein
Sandia National Laboratories

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