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Grid-independent large-eddy simulation (LES) of turbulent flow around a circular cylinder using explicit filtering SATBIR SINGH, DONGHYUN YOU, Carnegie Mellon University — The explicit filtering technique has the potential to provide grid-independent and error-quantified large-eddy-simulation (LES) solutions. Bose *et al.* [Phys. Fluids **22**, 105103 (2010)] and Singh *et al.* [Phys. Fluids **24**, 085105 (2012)] recently obtained grid-independent LES solutions for turbulent channel flow using one-dimensional discrete filter functions implemented on Cartesian grids. Many complex flow configurations, however, employ arbitrary shape grids, for which it is difficult to design such discrete filter functions. In the present work, we employ an elliptic differential filter to solve explicit-filter LES equations on arbitrary shaped grids. The coefficients of the elliptic filter are determined by comparing its filtering characteristics with those of a Gausian filter. The elliptic filter is applied to a homogeneous isotropic turbulence flow field and the coefficient is adjusted until a filtered energy spectra similar to that of the Gaussian filter is obtained. The filter coefficients thus obtained are then employed to solve explicit-filter LES equations for turbulent channel flow at $Re_\tau = 395$ and turbulent flow over a circular cylinder at $Re_D = 3900$. Grid-independent solutions are obtained for both flow configurations.

Satbir Singh
Carnegie Mellon University

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