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Implicit LES using Adaptive Filtering[1] G. SUN, J.A. DOMARADZKI, University of Southern California — In ILES numerical dissipation prevents buildup of small scale energy in a manner similar to the explicit SGS models. If spectral methods are used the numerical dissipation is negligible but it can be introduced by applying a low-pass filter in the physical space (Domaradzki et al., 2002), resulting in an effective ILES. We provide a comprehensive analysis of the numerical dissipation produced by different filters in a turbulent channel flow simulated using a non-dissipative pseudo-spectral solver. The amount of numerical dissipation imparted by filtering can be easily manipulated by changing how often a filter is applied. We show that when the additional numerical dissipation is close to the SGS dissipation of an explicit LES the overall accuracy of ILES is also comparable, indicating that periodic filtering can replace explicit models. Following the work of Tantikul and Domaradzki (2010) a new method is proposed, which does not require any prior knowledge of a flow, to determine the filtering period adaptively. Once an optimal filtering period is found, the accuracy of ILES is significantly improved at low implementation complexity and computational cost. The method is general, performing well for different Reynolds numbers, filter shapes, and grid resolutions.

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Julian Domaradzki
University of Southern California

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