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Fully adaptive LES of homogeneous turbulent flows GIULIANO
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Colorado at Boulder — With the recent development of wavelet-based techniques
for computational fluid dynamics, adaptive numerical simulations of turbulent flows
have become feasible. Adaptive wavelet methods are based on wavelet threshold
filtering that makes it possible to separate coherent energetic eddies, which are nu-
merically resolved, from residual background flow structures that are filtered out.
The prescription of a given threshold for wavelet filtering directly links to the desired
turbulence resolution. A new original strategy is presented for which the wavelet
filtering threshold is not prescribed a-priori but determined on the fly for a given
and known level of turbulence resolution. A completely adaptive eddy capturing
approach that allows to perform variable fidelity numerical simulations of homoge-
neous turbulent flows is proposed. The new method is based on wavelet filtering with
time-dependent thresholding that automatically adapts to the actual flow conditions
in order to achieve the desired level of turbulence resolution. The filtered govern-
ing equations supplemented by a localized dynamic energy-based closure model are
solved by means of the adaptive wavelet collocation numerical method.

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