TECHNISCHE UNIVERSITÄT DRESDEN

Institut für Strömungsmechanik, Professur für Strömungsmechanik

Vortrag

ILSA for LES – error-control in turbulence simulations

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We propose a new length scale as basis for the modelling of subfilter motions in large-eddy simulations (LES) of turbulent flow. Rather than associating the model length scale with the computational grid, we put forward an approximation of the integral length scale (ILSA). In this way we achieve a non-uniform flow coarsening through spatial filtering that reflects the local, instantaneous turbulence activity. Through the introduction of this grid-independent, solution-specific length scale it becomes possible to separate the problem of representing small-scale turbulent motions in a coarsened flow model from that of achieving an accurate numerical resolution of the primary flow scales. The formulation supports the notion of grid-independent LES, in which a prespecified reliability measure is used.

We discuss the concept of 'sub-filter activity' as a measure for the dominant error contributions in LES, i.e., modeling and discretization errors. The model coefficient in the ILSA eddy-viscosity formulation is adapted dynamically by steering the sub-filter activity toward a pre-defined target value. Both 'global' and 'local' ILSA models will be presented and validated in turbulent flow in a channel and over a backward facing step. The new models show excellent flow predictions, without adding much to the computational effort.

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