Parallel DNS simulation of a spatially developing planar turbulent jet

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ABSTRACT

Although spatial simulations of free shear flows are known to be much more realistic than temporal simulations, due to their high computational cost, very large spatial direct numerical simulations (DNS) of *e.g.* jets are still relatively rare. For the round and plane jets the reference simulations by Boersma *et al.* [1] and Stanley *et al.* [2] are still among the biggest DNS in existence. Large-eddy simulations (LES) of spatially evolving jets are also challenging but their numbers are increasing rapidly. A good example are the LES of jets carried out by Bogey and Bailly [3].

This work presents the biggest DNS of a spatially evolving turbulent plane jet in existence. The numerical simulation code used in the simulations uses very accurate pseudo-spectral and 6^{th} order "Compact" schemes for spatial discretization and a 3^{rd} order Runge-Kutta scheme for temporal advancement. A similar code was used to carry out the DNS of planar jets in [6].

The Reynolds number based in the jet inlet slot-width H is $Re_H = 3000$ and the jet extends to 154 half slot-widths. The total number of grid points along the streamwise (x), normal (y), and spanwise (z) directions is equal to $2576 \times 1568 \times 172$, respectively *i.e.* the total number of grid points approaching 700 million points.

During the congress results from the simulation will be shown focusing on the life time of the intense vorticity structures and on the self-similar jet behavior. Particular attention will be given to the dynamics of the region near the jet edges [7,8].

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