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Direct Numerical Simulation of turbulent flows generated by fractal grids SYLVAIN LAIZET, JOHN CHRISTOS VASSILICOS, Imperial College London, ERIC LAMBALLAIS, Laboratoire d'Etudes Aérodynamiques Poitiers, IMPERIAL COLLEGE LONDON COLLABORATION, LABORATOIRE D'ETUDES AÉRODYNAMIQUES POITIERS COLLABORATION — Recently at Imperial College London, experiments of turbulence generated by fractal grids placed at the entrance of a wind tunnel have shown that complex multiscale boundaries/initial conditions can generate a far downstream decaying homogeneous isotropic turbulence with broad power law (approximately -5/3) energy spectra but laminar-like dissipation (Hurst & Vassilicos, Seoud & Vassilicos 2007 in PoF). Although the wind tunnel measurements have provided invaluable time-resolved informations on the unique properties of multiscale generated turbulent flows, understanding the spatial structure of these flows is necessary to discover the origins of these properties. The goal of the present numerical study is to investigate the spatio-temporal flow structure and the properties of the turbulent flow generated by these fractal objects. To solve the incompressible Navier-Stokes equations, we use a numerical code (called "Incompact3d") based on sixth-order compact schemes for spatial discretization and second order Adams-Bashforth scheme for time advancement. These are very large simulations, in particular because of the multi-scale nature of the fractal turbulence generators, and require state-of-the art top-end parallel computing.

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