Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Direct numerical simulations of statistically-stationary homogeneous shear turbulence[1] ATSUSHI SEKIMOTO, SIWEI DONG, JAVIER JIMÉNEZ, U. Politecnica Madrid — The long-term behaviour of homogeneous shear turbulence is studied using a new direct simulation code. The incompressible Navier-Stokes and continuity equations are formulated in terms of the vertical vorticity and of the Laplacian of the vertical velocity. The domain is periodic in the streamwise (x) and spanwise (z) directions, and periodic between shifting points of the lower and upper y-boundaries. The discretization is dealiased Fourier in (x, z) and compact finite differences in y, with the shear-periodic boundary conditions embedded in the finite-difference matrices for each Fourier mode. There is no recurrent remeshing, thus avoiding the secular loss of enstrophy during long integration times. The code was validated using linear theory, as well as the initial shearing of isotropic turbulence. The results depend only weakly on the vertical box dimension. Over long times it develops the streaks and quasi-periodic bursting behaviour typical of wall-bounded turbulence, with mean shear parameters, Sq^2/ϵ, of the same order as those in the logarithmic layer of turbulent channels, suggesting that it can be used as a model for the self-sustaining mechanism of inertial wall turbulence.

[1]Funded by the ERC

Atsushi Sekimoto
U. Politécnica Madrid

Date submitted: 02 Aug 2012 Electronic form version 1.4