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Unstable periodic orbits in a homogeneous shear flow[1] ATSUSHI SEKIMOTO, SIWEI DONG, JAVIER JIMÉNEZ, U. Politécnica Madrid — Unstable periodic orbits (UPOs) are numerically obtained by a Newton-Krylov method in a homogeneous shear flow. The two classes of UPOs have a box-time period synchronized with that of the boundary condition, which is shear-periodic between shifting points of the upper and bottom boundaries of the computational box. The first one is characterized by the shift-reflection symmetry, and by staggered streamwise-inclined vortex pairs, as in Nagata's Couette equilibrium solution (*JFM* 217, 519-527 (1990)). The second is characterized by the mirror symmetry in the spanwise direction, similar to Townsend's sketch of a inclined double-roller eddy (*JFM* 41, 13-46 (1970)). It is revealed that the lower branch of the mirror-symmetric UPO has an important role in the transition to turbulence, and is an "edge-state" on the basin boundary between laminar and turbulent states, whose two unstable directions lead to direct laminarization and to turbulence bursting. We also present subharmonic UPOs, whose periods are longer than the periodicity of the boundary condition. The dynamic UPO represents the breakdown and regeneration of streaks, associating with the streamwise-inclined vortices, which is similar to the self-sustaining process in wall-bounded flows.

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