Turbulence Control in Pipe Flow by Means of Unsteady Driving

DAVIDE SCARSELLI, JOSÉ M. LOPEZ, ATUL VARSHNEY, BJÖRN HOF, IST Austria — Turbulent flows are responsible for huge energy losses in many diverse pumping applications ranging from heat exchange circuits to hydroelectric power plants. Several techniques to reduce frictional drag have been proposed over the last decades, however, very few have been tested experimentally and even less actually implemented. Based on the friction reducing properties observed in accelerating flows, we here propose a new approach to reducing drag by means of a pulsatile flow rate. We find 27% drag reduction in fully turbulent pipe flow in experiments and this is confirmed in direct numerical simulations. The optimal Reynolds number modulation is discussed. Different from many other drag reduction techniques, this operation mode does not require feedback loops, fluid additives or any modification to an existing pipeline.