Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

The Response of Modified Turbulent Pipe-Flow Targeting Distinct Fourier Modes at a Range of Reynolds Numbers MEHRAN MASOUMIFAR, SUYASH VERMA, ARMAN HEMMATI, University of Alberta — The response and recovery of turbulent pipeflow undergoing modification of its cross-sectional structure is examined using Reynolds-Averaged-Navier-Stokes (RANS) realizable k - ε model at Re=500-158600. The three-dimensional modification of the pipe cross-section was by targeting three distinct Fourier modes following the experiments of Van Buren et al. (2017). The reference case involved flow in a circular cross-section pipe with a length of 220D. The inserts are added to the pipe for the three cases based on a modified cross-section with an azimuthal Fourier mode of m=3 (Case I), m=15 (Case II), and m=3+15 (Case III). Preliminary results show that there exists a long-lasting effect on the flow, and the flow recovery is slow with the equilibrium not achieved at least 20D downstream of the insert at high Re. This reduces as the flow Re drops. Moreover, the combined Fourier mode insert (Case III) delays the flow recovery substantially, which is also accompanied by a smaller pressure drop compared to the other inserts. The effect of Reynolds number on the response and recovery is further examined for Case III. This study will expand into the effects on flow symmetry and unsteady behaviour for the dominant inserts.

Mehran Masoumifar
University of Alberta

Date submitted: 01 Aug 2020 Electronic form version 1.4