Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Feedback control of the bi-modal flow behind a blunt bluff body[1]

DANIA AHMED, AIMEE S. MORGANS, Imperial College London — The turbulent wake behind a square-back Ahmed body in close proximity to the ground exhibits bi-modal switching. This manifests as the centre of the wake switches between one of two asymmetric positions, either horizontally or vertically. Switches occur over random timescales, with the wake recovering symmetry in the long time-average. Large Eddy Simulations (LES) are employed to investigate feedback control strategies for suppressing wake bi-modality to reduce the drag. The unforced results establish a link between the wake switches and the coherent structures shed from the frontal separation bubble on the body surfaces upstream the wake. A model-based nonlinear controller is synthesized, based upon the nonlinear Langevin equation model. The controller successfully suppresses wake bi-modality, but amplifies higher frequencies, this hindering the drag reduction achieved by wake symmetrisation. A maximum drag reduction of 7.4% is achieved for a semi-symmetrised wake, while a fully symmetrised wake leads to 3% drag reduction.

[1]Islamic Development Bank, ARCHER computing facility

Dania Ahmed
Imperial College London

Date submitted: 03 Aug 2020 Electronic form version 1.4