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Feedback Control of the Wake of a Three-Dimensional Blunt Bluff Body THIBAULT FLINOIS[1], AIMEE MORGANS[2], Imperial College London — When cars or trucks drive on motorways, more than two thirds of their fuel consumption is due to aerodynamic drag, a significant part of which is caused by the large scale separation that takes place near their trailing edge. We tackle this problem using Large Eddy Simulations and use feedback control of synthetic jets to reduce the losses associated with large-scale structures in the wake. The geometry is a long surface mounted block, whose leading edge is not modelled for computational efficiency and the structure of the unforced flow field around this body is similar to the flow over a surface mounted block or hump. Considering this flow field as a control system, the base pressure force was used as the system output and the input is a slot jet actuator located near the trailing edge. Using open-loop forcing, a form drag reduction of about 7.5% was obtained. Open-loop system identification also allowed a transfer function that models the system's response to actuation to be found. Finally, a set of feedback controllers were applied to the plant and their performance was analysed. These controllers successfully reduce the fluctuations in the near wake, with only a small control effort. However, more significant mean drag reductions are expected at higher Reynolds numbers.

[1]PhD Student, Imperial College London
[2]Senior Lecturer, Imperial College London

Thibault Flinois
Imperial College London

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