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Estimation and feedback control of vortex shedding SIMON ILLINGWORTH, University of Melbourne — We consider estimator-based control of the cylinder wake in low-Reynolds-number simulations. There are two parts to the study. In the first part, we show that feedback control with a single sensor becomes increasingly difficult as Reynolds number increases. This is because of a larger region of absolute instability. The convective nature of the flow means that the single sensor is unaware of what is happening downstream of it, making feedback control very difficult. This motivates the second part of the study, where we consider estimator-based feedback control. Keeping with a single sensor measurement, we investigate how well one can estimate the entire flow field using only this single sensor. To do so we use a Kalman filter, and excellent results are seen. We then combine this Kalman filter with suitable feedback control laws to suppress vortex shedding. This control strategy still uses only a single sensor but, crucially, the control actions are based on (the estimate of) what is happening in the full domain. This control strategy achieves much better suppression in the far wake when compared with the single-sensor controller without estimator.

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