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Vortex-model based control of turbulent wakes in an experiment[1]
MARK PASTOOR, LARS HENNING, IAV GmbH, Germany, BERND R. NOACK, RUDIBERT KING, Berlin Institute of Technology, GILEAD TADMOR, Northeastern University, Boston — High energy costs, dwindling resources and the threat of global warming necessitates the development of efficient engines and transport vehicles. As aerodynamic design is technically mature in many cases flow control has the potential to dramatically increase the performance. Vortex-based reduced-order models explain, develop and improve control strategies for wake flows. By synchronizing the vortex shedding in a bluff body wake the pressure-induced drag decreases by 15% at Reynolds number 70000. This rate has been achieved with less than 50% of the actuation power compared to other strategies. Furthermore, the strategy is robust under changing operating conditions. A model of the flow around a second body in the wake of a body ahead is derived from vortex methods and utilized to design a dynamic observer for the reconstruction of the flow field. This model enables a real-time prediction of vortex positions and sensor readings in parallel to an experiment.

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