Abstract Submitted
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Control of the cylinder wake in the laminar regime by Trust-Region methods and POD Reduced Order Models CORDIER LAURENT, MICHEL BERGMANN, JEAN-PIERRE BRANCHER, L.E.M.T.A., 54504 Vandoeuvre-lès-Nancy, France — The optimal control approach for the active control of the circular cylinder wake flow considered in the laminar regime ($Re = 200$) is investigated. The objective is the mean drag minimization of the wake where the control function is the time harmonic angular velocity of the rotating cylinder. In order to reduce the computational costs, the optimization process is not based on the Navier-Stokes equations as state equations but rather on low-fidelity models derived with the Proper Orthogonal Decomposition (POD). Since the range of validity of this POD Reduced Order Model (ROM) is generally restricted to the vicinity of the design parameters in the control parameter space, the Trust-Region Proper Orthogonal Decomposition (TRPOD) approach, originally introduced by Fahl (2000), is used to update the ROMs during the optimization process. Benefiting from the trust- region philosophy, rigorous convergence results guarantee that the iterates produced by the TRPOD algorithm will converge to the solution of the original optimization problem defined with a high fidelity model. When the TRPOD is applied to the wake flow configuration, this approach leads to a relative mean drag reduction of 30% for reduced numerical costs.

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