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Drag Reduction in the Flow around a Cylinder: A Bayesian Optimization Approach[1] ANTHONY LARROQUE, MIGUEL FOSAS DE PANDO, Department of Mechanical Engineering and Industrial Design, University of Cadiz, LUIS LAFUENTE, Department of Mathematics, University of Cadiz — Bayesian Optimization has recently gained popularity as an effective optimization method to deal with expensive black-box objective functions. Advantages of this method include the ability to determine the global minimum at a reduced number of iterations, and the possibility to include uncertainty in the evaluation of the objective function. Recent developments also include parallel function evaluations or multiple sources of information with varying fidelity. All these features render Bayesian Optimization a promissing tool for Direct Numerical Simulations or Large Eddy Simulations, where the computational cost of determining the cost function, such as the drag coefficient, is typically very high, and the computational resources are very limited. In this work, we consider the three dimensional flow around a cylinder and apply Bayesian Optimization to determine the optimal blowing and suction strategy at the wall that leads to a minimum drag coefficient. The efficiency of the resulting optimization scheme is compared to alternative methods. Finally, we discuss the optimal parameters of the velocity profile, the underlying physical mechanisms, and the influence of the Reynolds numbers on the optimal solutions.

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