Energetically efficient Proportional-Integral control of flow past a circular cylinder[1] PRAMODE KESAVADAS, VIJAY ANAND, B.S.V. PATNAIK, A.J. SHAIJU, Indian Institute of Technology - Madras, Chennai — In this numerical study, we present an energetically efficient Proportional (P) and Integral (I) control strategy for the cessation of vortex shedding behind a circular cylinder. Reflectionally symmetric controllers are designed such that, they are located on a small sector of the cylinder over which, tangential sliding mode control is imparted. Energetically efficient optimal parameters for the P, I and PI controls have been numerically assessed. An estimation of the time-averaged kinetic energy of different flow regimes using Proper Orthogonal Decomposition (POD) is also carried out. These values are obtained with and without the optimal controllers. The Navier-Stokes equations along with an evolution equation for the PI controller, is numerically solved using finite volume method. The optimization procedure is formulated as a standard Linear Quadratic (LQ) problem and the time-averaged kinetic energy is obtained by summation of POD eigenvalues. The energetic efficiency for the, I controller was observed to be superior compared to the other two classes of controllers. By performing detailed fluid flow simulations, it was observed that, the system is energetically efficient, even when the twin eddies are still persisting behind the circular cylinder.

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