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Active control strategy for the vortex-induced vibration of sphere via near-wake jet flow[1] AMIR CHIZFAHM, RAJEEV JAIMAN, The University of British Columbia, THE UNIVERSITY OF BRITISH COLUMBIA TEAM — We present an active base bleed flow control strategy for the unsteady wake flow and the vortex-induced vibration (VIV) of spheres at low Reynolds number. For the proposed control strategy, a reduced-order model (ROM) is developed by the eigensystem realization (ERA) algorithm, which provides a low-order representation of the unsteady flow dynamics in the neighborhood of the equilibrium steady state. The actuation is considered via near-wake jet at the base side of the bluff body. The resulting controller designed by linear low-order approximation can suppress the nonlinear saturated state, which further confirms our earlier hypothesis about the linear mechanism in a nonlinear self-sustained VIV phenomenon. A systematic linear ROM-based stability analysis is performed to understand the eigenvalue distributions of elastically mounted spheres. Results from the ERA-ROM analysis are consistent with those obtained from fully nonlinear fluid-structure interaction simulations. A sensitivity study on the bleed coefficient has been performed to obtain the optimum actuation effort. Overall, the proposed control is found to be effective in suppressing the vortex shedding and the VIV for a range of reduced velocities and mass ratios.

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Amir Chizfahm
The University of British Columbia

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