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Cluster-based Reduced-order Modelling of Flow in the Wake of a Seal-vibrissa-shaped Cylinder[1] ZHENG WEI, QILIANG LI, ZHIGANG YANG, CHAO XIA, Tongji University, SHANGHAI AUTOMOTIVE WIND TUNNEL CENTER TEAM — The flow around a seal-vibrissa-shaped cylinder is numerically calculated using large eddy simulation (LES) at the Reynolds number of 20000, along with a smooth and a twisted cylinder for comparison. The mean drag coefficient of the seal-vibrissa-shaped cylinder is lower than that of the smooth and twisted cylinders, respectively. The fluctuating lift coefficient of the seal-vibrissa-shaped cylinder shows a substantial decrease compared with the smooth cylinder. The seal-vibrissa-shaped surface leads to more stable wake, longer vortex formation length, higher base pressure and three-dimensional separation. In addition, cluster-based reduced-order modelling (CROM) is performed to analyze phase-dependent variations of the wake flow, which discloses the complex unsteady behavior in different cross sections. Meanwhile, two flow regimes, anti-phased and in-phase-dominated vortex shedding, generated by the twisted cylinder and the seal-vibrissa-shaped cylinder are distinguished and extracted, their interrelationship are evaluated, and the question how forces are affected is answered.

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