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Influence of the Circular Cylinder Cross-Sectrion Variation on the Near Wake Behaviour

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Flow past a circular cylinder started impulsively into radial vibration is investigated by visualizing the flow patterns by smoke release and by analyzing qualitatively (flow topology) and quantitatively (PIV and anemometry measurements) the corresponding images. The considered Reynolds numbers range corresponds to the subcritical regime (10 000<Re<70 000). The details of the mechanisms of the near wake shedding are particularly considered and the actuation influence on the flow behaviour are pointed out. The drag coefficient decreasing to reach negative values propelling thus the cylinder is confirmed by the numerical results obtained by solving the Navier–Stokes equations. Furthermore, the new phenomenon of radial flow creation by diameter increasing-decreasing motion and primary vortices coalescence and dislocation have been identified in the near wake region. The analysis of flow properties such as drag and vorticity provide important information on the validity of a new cylinder wake control technique proposed herein and which can be extended to unsteady separated flows around bluff bodies.

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