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Numerical simulation of the dynamics of a flexible cantilevered plate subjected to a perpendicular or a parallel fluid flow FABIEN SANSAS, ERIC LAURRENDEAU, FREDERICK GOSSELIN, Ecole Polytechnique de Montreal — We focus on the dynamic deformation of a cantilevered flexible plate immersed in a fluid flow. The following two-dimensional numerical study is based on a large deformation beam model solved by finite difference. The fluid is computed by an in-house Arbitrary Eulerian-Lagrangian (ALE) compressible CFD solver. After a validation and verification procedures confirming second order accuracy, two different cases are examined. The first case serves as a validation exercise for the coupling procedure with the flow parallel to the plate: its leading edge is clamped and the trailing end is free. This case models a flapping flag for which the stability of the plate as a function of its mass and flow velocity are investigated. Different vibration modes are compared to previous numerical and experimental results. The second case is that of a plate clamped at its middle, the flow being perpendicular to its initial shape. The plate deforms by bending in the flow direction. Streamlining and projected area reduction lead to fluid forces reduction but, at some point, dynamic instability occurs. Preliminary results of this instability phenomena are presented, namely the various dynamic behaviours and the trade-offs between streamlining and instability.

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