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Decomposing the aerodynamic forces of low-Reynolds flapping airfoils[1] MANUEL MORICHE, MANUEL GARCIA-VILLALBA, OSCAR FLORES, Universidad Carlos III de Madrid — We present direct numerical simulations of flow around flapping NACA0012 airfoils at relatively small Reynolds numbers, $Re = 1000$. The simulations are carried out with TUCAN, an in-house code that solves the Navier-Stokes equations for an incompressible flow with an immersed boundary method to model the presence of the airfoil. The motion of the airfoil is composed of a vertical translation, heaving, and a rotation about the quarter of the chord, pitching. Both motions are prescribed by sinusoidal laws, with a reduced frequency of $k = 1.41$, a pitching amplitude of 30deg and a heaving amplitude of one chord. Both, the mean pitch angle and the phase shift between pitching and heaving motions are varied, to build a database with 18 configurations. Four of these cases are analysed in detail using the force decomposition algorithm of Chang (1992) and Martín Alcántara et al.(2015). This method decomposes the total aerodynamic force into added-mass (translation and rotation of the airfoil), a volumetric contribution from the vorticity (circulatory effects) and a surface contribution proportional to viscosity. In particular we will focus on the second, analysing the contribution of the leading and trailing edge vortices that typically appear in these flows.

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