

INTERACTION OF INCOMPRESSIBLE FLOW AND A MOVING AIRFOIL*

MARTIN RŮŽIČKA[†], MILOSLAV FEISTAUER[†], JAROMÍR HORÁČEK[‡], AND PETR SVÁČEK[§]

Abstract. The subject of this paper is the numerical simulation of the interaction of two-dimensional incompressible viscous flow and a vibrating airfoil. A solid airfoil with two degrees of freedom can rotate around an elastic axis and oscillate in the vertical direction. The numerical simulation consists of the finite element solution of the Navier-Stokes equations coupled with a system of ordinary differential equations describing the airfoil motion. The time-dependent computational domain and a moving grid are taken into account with the aid of the Arbitrary Lagrangian-Eulerian formulation of the Navier-Stokes equations. High Reynolds numbers require the application of a suitable stabilization of the finite element discretization. Numerical tests prove that the developed method is sufficiently accurate and robust. The results are compared with experiments.

Key words. aeroelasticity, Navier-Stokes equations, arbitrary Lagrangian-Eulerian formulation, finite element method, stabilization for high Reynolds numbers

AMS subject classifications. 65M60, 76M10, 76D05

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[†]Charles University Prague, Faculty of Mathematics and Physics, Sokolovská 83, 186 75 Praha 8, Czech Republic (mart.in.ruza@seznam.cz, feist@karlin.mff.cuni.cz).

[‡]Institute of Thermomechanics of the Academy of Sciences of the Czech Republic, Dolejškova 5, 182 00 Praha 8, Czech Republic (jaromirh@it.cas.cz).

[§]Czech Technical University Prague, Faculty of Mechanical Engineering, Karlovo n. 13, 121 35 Praha 2, Czech Republic (svacek@marian.fsi.cvut.cz).