LadHyX Seminar – June 2, 11:00, – LadHyX Library

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Towards a model of a deformable aerofoil

Aerofoils that include flexible components are designed to enhance aerodynamic capability and to promote fuel efficiency under a range of different flight conditions. Some small, unmanned aerial vehicles (UAVs) use entirely collapsible, elastic wings to maximise portability. In this talk we work toward a model of a deformable aerofoil by studying the behaviour of a thin-walled elastic cell in a uniform stream. We use a conformal mapping approach to determine the cell shape and the ambient flow simultaneously. Our initial analysis of a light cell in an oncoming flow can be viewed as a generalisation of Flaherty et al.'s 1972 work on the buckling of an elastic cell under a constant transmural pressure difference. Introducing cell mass and circulation/lift, we study equilibrium shapes at different flow speeds and for different transmural pressure jumps. A fixed-angle corner at the trailing edge is introduced by way of a Karman-Trefftz conformal mapping, and an internal strut is included, to more accurately mimic the shape and aerodynamic properties of a traditional, rigid aerofoil. DNS simulations are carried out to assess the performance of the equilibrium aerofoil shapes in a real flow.