A finite element method for the solution of the full-potential equation with an embedded wake

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Abstract:

Potential flow solvers represent an appealing alternative for the simulation of non-viscous subsonic flows. In order to deliver accurate results, such techniques require prescribing explicitly the so called Kutta condition, as well as adding a special treatment on the "wake" of the body. The wake is traditionally modelled by introducing a gap in the CFD mesh, which requires an often laborious meshing work. The novelty of the proposed work is to embed the wake within the CFD domain. The approach has obvious advantages in the context of aeroelastic optimization, where the position of the wake may change due to evolutionary steps of the geometry. This work presents a simple, yet effective, method for the imposition of the embedded wake boundary condition. Although this work is concerned with the embedded modelling of the wake, it is planned in the future to combine this technique with the methods described in [1], in order to use a fully immersed description of the geometry of interest.
The presented method preserves the possibility of employing iterative techniques in the solution of the linear problems which stem out of the discretization. The solver is implemented in Kratos Multi-Physics, an open source framework to develop multidisciplinary programs [2]. Validation and verification of the solver are performed for a NACA 0012 airfoil.

References:

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