Finite element solution of compressible flow in time-dependent domains

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The paper is concerned with the modelling of inviscid, compressible flow in time-dependent domains. This problem plays an important role in several areas of research, as for example, flow past an oscillating airfoil or flow in human vocal folds. For investigation of such type of flow we consider the system of the Euler equations describing the motion of compressible flow. The time-dependence of the computational domain is taken into account with the aid of the Arbitrary Eulerian-Lagrangian method. Using this method, we derive two different formulations of the Euler equations. The space discretization of the governing system in the ALE formulation is carried out by the discontinuous Galerkin finite element method. For the time discretization a semi-implicit technique is developed, which is unconditionally stable and allows the solution of compressible flow with a wide range of Mach numbers. Numerical experiments carried out for the case of flow through a channel with a moving wall show the applicability and robustness of the method.

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