Discontinuous Galerkin Method for Interaction of Compressible Flow and Structures

M. Feistauer and V. Kučer and J. Prokopová

Charles University Prague, feist@karlin.mff.cuni.cz

The subject of this paper is the numerical simulation of the interaction of two-dimensional compressible flow and structures. Namely, the interaction with a vibrating airfoil or a channel with a moving wall will be considered. The gas flow is described by the Euler or Navier-Stokes equations. They will be discretized by the discontinuous Galerkin finite element method (DGFEM) using piecewise polynomial discontinuous approximations written in the ALE form. We use a special treatment of boundary conditions, shock capturing, special semi-implicit time discretization and isoparametric elements at curved boundaries, allowing the solution of flow with a wide range of Mach numbers. A solid airfoil with two degrees of freedom can rotate around the elastic axis and oscillate in the vertical direction. Its motion is described by a system of two second-order ordinary differential equations discretized by the Runge-Kutta method, coupled with the DGFEM for the solution of the flow problem. In the case of a channel flow we assume that a part of one wall can oscillate.