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# FLUID STRUCTURE INTERACCION WITH HIGH ORDER DISCONTINUOUS GALERKIN METHODS

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## ABSTRACT

We consider high fidelity simulations of aerodynamic problems exhibiting significant fluid structure interaction. We will present our discontinuous Galerkin methodology for the discretization of convection-diffusion systems and also address efficient solution strategies[1,4]. In order to handle problems involving variable geometries, we introduce a continuous mapping [3] between a fixed reference configuration and the time varying domain. By writing the Navier-Stokes equations as a conservation law for the independent variables in the reference configuration, the complexity introduced by variable geometry is reduced to solving a transformed conservation law in a fixed geometry. The spatial discretization is carried out using the Discontinuous Galerkin method on unstructured meshes of triangles, while the time integration is performed using either an explicit Runge-Kutta method or BDF formulae.. A number of results involving biologically-inspired flight will be shown to illustrate the flexibility of the approach to handle high order approximations on complex geometries.

## REFERENCES

[1] J.PERAIRE and P.O.PERSSON, 'The compact discontinuous Galerkin (CDG) method for elliptic problems', to appear in the SIAM Journal for Scientific Computing, 2007.

[2] P.O.PERSSON, J.PERAIRE and J.BONET, 'Discontinuous Galerkin solution of the Navier-Stokes equations on deformable domains', presented at AIAA Conference, AIAA-2007-0513, Reno, NV, January 2007.

[3] D.J.WILLIS, J.PERAIRE and K.S.BREUER, 'A computational investigation of bio-inspired formation flight and ground effect', presented at AIAA Conference, AIAA-2007-4182, Miami, FL, June 2007.

[4] P.-O.PERSSON and J.PERAIRE, 'Newton-GMRES preconditioning for discontinuous Galerkin discretizations of the Navier-Stokes equations', to appear in the SIAM Journal for Scientific Computing, 2007.