

Analytic aspects for fluid-structure interaction and numerical simulations for structure dynamics and fluid flow, test examples

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It is observed that when a fluid interacts with a solid structure, exerting pressure, that may cause deformation in the structure and, thus, alter the flow of the fluid itself. This deformation of a solid structure, changes the boundary condition of the fluid problem. These problems appear to have wide engineering applications such as the flow of gases in internal combustion engines where the piston head has a periodic motion with respect to the cylinder walls, modifying the available flow volume accordingly.

In the current work we present some analytic aspects related to fluid structure coupling and in order to test some numeric schemes, for structure and for fluid flow separately, we present some numerical simulations.

References

- [1] Blom F. J., *A monolithic fluid-structure interaction algorithm applied to the piston problem*, *Comp Meth Appl Mech Engrg* 1998; 134:17-112.
- [2] Zuijlen A. H. V., *Implicit and explicit higher order time integration schemes for structure dynamics and fluid-structure interaction computations*, *Computers & Structures* 2005; 83: 93-105.
- [4] Kennedy C. A., *Additive Runge-Kutta Schemes for Convection-Diffusion-Reaction equations*, *Applied Numerical Mathematics* 2003; 44:139-181.
- [5] Bardella L., *Time integration errors and some new functionals for dynamics of a free mass*, *Computers & Structures* 2003; 81:2361-2372.
- [6] John D. Anderson, JR. *Computational Fluid Dynamics: The basics with applications*, McGraw-Hill 1995.
- [7] Fausett, L. V., *Applied Numerical Analysis Using MATLAB*, Pearson Prentice Hall 2008.