Abstract:
The coupling of flexible structures to incompressible fluids draws a lot attention during the last decade. Many different solution schemes have been proposed. In this contribution we concentrate on strong coupling fluid-structure interaction by means of monolithic solution schemes. Therein, a Newton-Krylov method is applied to the monolithic set of nonlinear equations. Such schemes require good preconditioning to be efficient. We propose two preconditioners that apply algebraic multigrid techniques to the entire fluid-structure interaction system of equations. The first is based on a standard block Gauss-Seidel approach where approximate inverses of the individual field blocks are based on an algebraic multigrid hierarchy tailored for the type of the underlying physical problem. The second is based on a monolithic coarsening scheme for the coupled system that makes use of prolongation and restriction projections constructed for the individual fields. The resulting nonsymmetric monolithic algebraic multigrid method therefore involves coupling of the fields on coarse approximations to the problem yielding significantly enhanced performance.