Analysis of a 3d nonlinear, moving boundary problem describing fluid-mesh-shell interaction

Marija Galić

Department of Mathematics, Faculty of Science, University of Zagreb, Croatia

marija.galic@math.hr

Abstract

We consider a nonlinear, moving boundary, fluid-structure interaction problem between an incompressible, viscous fluid flow, and an elastic structure composed of a cylindrical shell supported by a mesh-like elastic structure. The fluid flow is modeled by the time-dependent Navier-Stokes equations in a three-dimensional cylindrical domain, while the cylindrical shell is described by the two-dimensional linearly elastic Koiter shell equations allowing displacements in all three spatial directions. The mesh-like structure is modeled as a one-dimensional hyperbolic net made of linearly elastic curved rods. The fluid and the mesh-supported structure are coupled via the kinematic and dynamic boundary coupling conditions describing continuity of velocity and balance of contact forces at the fluid-structure interface. We prove the existence of a weak solution to this nonlinear, moving boundary problem by using the time-discretization via Lie operator splitting method, Arbitrary Lagrangian-Eulerian mapping and non-trivial compactness result. This is a joint work with Sunčica Čanić and Boris Muha.