
Navier-Stokes equations on surfaces: Analysis and numerical simulations

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Abstract

In this presentation we consider a Navier-Stokes type system, posed on a smooth closed stationary or evolving two-dimensional surface embedded in three dimensional space. We briefly address modeling aspects related to this system. We introduce the so-called tangential surface Navier-Stokes equations and discuss a well-posed weak variational formulation of this PDE system that forms the basis for finite element discretization methods. Furthermore we explain the basic ideas of an unfitted finite element method, known as TraceFEM, that is used in our numerical simulation of the tangential surface Navier-Stokes system. Results of numerical experiments with this method are presented that illustrate how lateral flows are induced by smooth deformations of a material surface.

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