Convergence of the Lagrange-Galerkin method for fluid-structure interaction problems

Loredana Smaranda

Department of Mathematics and Computer Science, University of Piteşti,
Str. Targu din Vale nr.1, 110040 Piteşti, Romania
loredana.smaranda@upit.ro

We focus on a numerical method for the disctretization of an initial and boundary value problem that models the self–propelled motion of one deformable solid in a bidimensional viscous incompressible fluid. In the model, we suppose that the solid is subjected to a known deformation field representing the action of the aquatic organism muscles. The governing equations consist of the Navier-Stokes equations for the fluid, coupled to Newton's laws for the solid. The numerical method we propose is based on a global weak formulation, where the nonlinear term in the Navier–Stokes model is discretized using the characteristic function. Since the formulation is global in space, this characteristic function is extended in an appropriated manner inside of the creature, taking into account its deformation. In this talk, we concentrate our attention in the semi-discretization in time and we prove the stability and the convergence of the numerical scheme. The numerical method is consistent enough with the motion of the creature and for this reason, the disctretization in space variable is successfully implemented using finite element method.