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ABOUT THE MODELLING OF LOW-REYNOLDS NUMBER FLUID-STRUCTURE INTERACTIONS

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ABSTRACT

Despite the term “fluid-structure interaction” is usually employed to describe the interaction between large scale structures and high-speed flows, applications at small scales, including microelectromechanical systems (MEMS), elasto-hydrodynamic lubrication (EHL), membranic boundaries-flow (such as flows in vesicles or arteriae) or the locomotion of microscopic organisms, have recently been increasedinterest. In particular, one of the most interesting cases of fluid-structure interaction at low Reynolds number is whenever a viscous laminar flow is coupled to soft, deformable boundaries whose shapes are influenced by the flow. Since the flow is changed when the location of the boundary changes, there is a strong coupling between the solid deformation and the viscous flow dynamics. The complexity of the problem is exacerbated by the geometry of the contacting surfaces –roughness has a power spectrum extending up to 6 order of magnitude- and to the rheology of the solids and the fluid in the interacting system. Indeed, phenomena due to plasticity or, especially in the presence of soft materials, to viscoelasticity, and the effects of a Non-Newtonian fluid have to be accounted for.

This mini-symposium will deal with the techniques developed to study these problems. In particular, the majority of the sessions will focus on multi-scale numerical techniques to tackle fluid-structure interactions at low-Reynolds number using continuum, atomistic or hybrid models. Applications in mechanical engineering industry, biotechnology and medicine will be discussed by the presented talks. Furthermore, some of the sessions will also be dedicated to the methodologies to analyse flow instabilities induced by the solid deformation.
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