MECHANICALLY CONSISTENT MODELING OF FLUID-STRUCTURE-CONTACT INTERACTION WITHOUT COLLISION PARADOX

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The numerical simulation of systems involving fluid-structure-contact interaction raises many modeling, mathematical and numerical issues. It is also crucial for numerous biomedical applications (e.g., native or artificial cardiac valves). Modeling contact between solids adds challenging difficulties to fluid-structure interaction (FSI). First, in some configurations, FSI models are unable to predict contact; this is the so called no collision paradox. A second major issue is to obtain mechanically consistant models. Indeed, the simple addition of a contact constraint leads to mechanical inconsistencies like unphysical void creation at releases from contact or unbalanced stress at contact. A favored approach is to consider a porous modeling of the fluid seepage induced by the roughness of the contacting solid. In this talk we will show that, in the case of a rigid disk moving over a fixed horizontal plane, adding a surfaced Darcy model on the plane does encompass contact, and hence removes the above mentioned non collision paradox of traditional FSI models which rely on Dirichlet or Dirichlet/Navier boundary conditions. Numerical evidence on this result will also be provided. Finally, we will explore the extension of poroelastic modeling of seepage to the case of moving elastic solids.