Existence and uniqueness of strong solutions to the bi-dimensional fluid-structure interaction system

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In this talk, I will present a joint work and recent result on fluid structure inter- action problem with C. Grandmont [2]. The objective of this work is to study a periodic unsteady non-linear fluid-structure interaction problem where a two-dimensional viscous incompressible Newtonian fluid and a mono-dimensionnal elastic structure, located on one part of the fluid domain boundary, interacts. The fluid motion is modelled by the bi-dimensional incompressible Navier-Stokes equations set in an unknown domain which depends on the structure's displacement. We consider longitudinal as well as transversal structure displacement. We assume that the longitudinal displacement of the structure satisfies a wave equation whereas the transversal displacement follows a beam equation with inertia of rotation. The fluid and structure systems are coupled through a kinematic condition which corresponds to a no-slip condition at the fluid-structure interface and the fluid exerts a force on the elastic structure. We prove the existence and uniqueness of strong solution to the considered problem with no gap between the initial conditions regularity and the ones obtained in positive time. To our knowledge, this is the first result regarding existence and uniqueness of strong solutions for fluid-beam interaction problem in the unsteady case taking into account both the transversal displacement and the longitudinal structure displacement. We emphasize that the main novelty is to take into account the longitudinal displacement of the elastic beam, leading in particular to a non linear volume constraint that couples both displacement, the need to have a uniform Korn inequality, and extra pressure terms that we need take care of contrary to the case on only transversal displacement [1]. Moreover we do not add any damping to the equations but take into account the inertia of rotation effect. References

References

[1] C. Grandmont and M. Hillairet: *Existence of Global Strong Solutions to a Beam-Fluid Interaction System*, Arch. Ratio. Mech. Anal., 220(3): 205-255, 2016.

[2] C. Grandmont and L. Sabbagh: *Existence and Uniqueness of Strong Solutions to the Bi-dimensional Fluid-Structure Interaction System*, preprint.