Existence and collision results for some fluid-elastic coupling

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In this talk we will focus on a two-dimensional coupled fluid-structure problem that can be viewed as a first step to model the blood flow in arteries. The fluid is supposed to be Newtonian, viscous and incompressible. It is described by the Navier-Stokes equations whereas the structure will be a thin linear elastic structure located on one part of the fluid boundary. We will consider here an elastic structure whose displacement $\boldsymbol{d}$ is decomposed into two components: ξ the longitudinal one and η the radial or transversal one, satisfying rod or beam equations with possible damping terms.

The existence of strong solutions has been studied in [5] in the steady state case, in [4], [6] in the unsteady case with $\xi = 0$ and the existence of weak solution in [2], [4] for the tri-dimensional unsteady case and in [1] in a two-dimensional setting also with $\xi = 0$ (i.e. transfers motion only). Note that in [4] and [1] the structure is not damped.

Here, in a first part we will consider the steady version of this problem and prove existence of a unique strong solution for different kind of boundary conditions for the fluid on the part which is not the fluid-structure interface. We will try to underline the effect of these different boundary conditions on the regularity of the solution.

In a second part, that corresponds to a joint work with M. Hillairet, we will focus on the unsteady case but with $\xi = 0$ and in particular investigate the possible contact between the structure and the bottom of the fluid cavity. We will also discuss the existence of weak or strong solutions with respect to collision and to the additional damping term.

References

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