# Local feedback stabilization of a fluid-structure model

JEAN-PIERRE RAYMOND

Institut de Mathématiques, UMR 5219,
Université Paul Sabatier, 31062 Toulouse cedex 09, France
*e-mail*: raymond@mip.ups-tlse.fr

**Abstract**

We study a system, in two dimensions, coupling the Navier-Stokes equations with a damped beam equation modelling the interaction between an incompressible fluid flow and a flexible structure placed at the boundary of the domain occupied by the fluid. Under some geometrical conditions we show that the coupled system can be exponentially stabilized by a control acting only in the beam equation. In this setting, the domain occupied by the fluid is changing when the structure is bent.

We prove that the linearized system around a stationary solution can be written as a system for which the semigroup is analytic and has a compact resolvent. When the stationary solution is zero the stabilizability of the system follows from an approximate controllability result due to Osses and Puel (99). For a system linearized around a Poiseuille flow in a channel the stabilizability result follows from a result obtained by Barbu for the Navier-Stokes equations with a normal control (07).

By considering an optimal control problem, we determine a control stabilizing the linearized system in feedback form. The feedback operator is obtained by solving an algebraic Riccati equation.

By a fixed point argument, we next show that the linear feedback control locally stabilizes the nonlinear system.

**Key Words:** Feedback stabilization, fluid-structure system, Algebraic Riccati equation