

Fluid-structure interactions with elastic contact - Numerical Modeling and Benchmarking

Tuesday 18 February 2025 09:00 (45 minutes)

We consider an elastic solid, e.g. a ball, which sinks towards the ground in a container filled with a liquid. The ball bounces off the bottom.

From a mathematical point of view, it is not clear what exactly happens. Assuming that the Navier-Stokes equations describe the situation, contact should not occur. The common hypothesis is that if the surface of the sphere is assumed to be perfectly smooth, a thin film of liquid always remains, the forces are transferred into the solid body via this film and are released again due to the elasticity. This results in a rebound without any contact.

In the lecture, the numerical difficulties of simulating such a problem are discussed. The various common approaches, e.g. ALE coordinates or purely Eulerian formulations, all have their own challenges to overcome.

We show that a simulation is possible without adding parameterized additional models to describe the rebound. However, this requires an immense effort. In addition, we present experimental and numerical benchmark problems as well as computational results.

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