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Parametric solvers for simulation of blood flows

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ABSTRACT

This work deals with the simulation of cardiovascular flows. These are described, at macroscopic level, by systems of non-linear parametric PDEs describing the mechanical behaviour of the blood and the vessels (or cardiac) walls. In many realistic applications, the knowledge of the parameters as well as the boundary conditions is not perfect. When performing Uncertainty Quantification (UQ), data assimilation, or control and optimisation tasks, it is crucial to have a good approximation of the system solution as function of the parameters and boundary conditions.

We propose numerical methods [1, 2, 3] to approximate the solutions of parametric PDEs, formulated as high-dimensional problems. In particular, we will focus, first, on linear fluid-structure interaction systems. We will then present a more general approach to deal with non-linear systems and with the parametric Navier-Stokes equations. Some tests are proposed on the simulation of Navier-Stokes in realistic geometries as well as examples of how such a parametric solver can be exploited to perform UQ or to speed up data assimilation problems [4].

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