Fluid-structure interaction problems in computational hemodynamics

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Talk Abstract

In this talk we consider fluid-structure interaction (FSI) problems arising in the context of hemodynamics. In such a field, the numerical solution of FSI may be very challenging due to the similar values of fluid and structure densities. In the first part of the talk we discuss the efficiency, stability and accuracy of a family of loosely coupled partitioned algorithms, based on the solution of just one fluid and structure problem at each time step. We report theoretical results about stability and then numerical results in a real dataset of human carotids to study the effect of different plaque typologies on plaque stability. We also propose and apply such algorithms for cardiac FSI problem where also the coupling with electro-physiology is addressed. In the second part of the talk, we provide some preliminary results obtained in the direction of modeling plaque progression. To this aim, we introduce a model composed by the FSI problem coupled with other partial differential equations describing at the macroscopic level the cellular processes leading to plaque progression. We propose a numerical method to solve this highly nonlinear system of PDEs characterized by different time scales and we present some numerical results.

Keywords: Fluid-structure interaction, loosely coupled algorithms, plaque progression

Acknowledgements
This work was partially supported by the European Research Council (ERC) under the European Unions Horizon 2020 research and innovation programme (grant agreement No. 740132, iHEART -An Integrated Heart Model for the simulation of the cardiac function) and by Istituto Auxologico Italiano (Grant Agreement No. 20 07 21 04, FLUIDODINAMIC-AUX).