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THE COUPLING OF MULTISCALE MODELS IN HEMODYNAMICS AND HEMORHEOLOGY

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In spite of the advances in power of modern computers, the mathematical modelling and numerical simulation of the cardiovascular system remains a very difficult task, due its complexity in geometry and functionality [1]. Even if only restricted regions of the arterial tree are at study, it is most important to take into account the global circulation into local simulations.

In this talk we present the geometrical multiscale approach [4; 3], consisting in coupling a hierarchy of models, with different levels of complexity and detail. In this way the most adequate model can be applied to each part, or type of investigation at hand, of the cardiovascular system in an integrated manner. We describe each model, starting from the 3D generalized Newtonian fluid-structure interaction model, applied in regions where detail information on blood flow dynamics is required, to 1D hyperbolic and 0D or lumped parameters models, representing large parts of the arterial tree and wide compartments such as the heart, respectively. The different mathematical nature of all these models makes their integration the main challenge of this technique [2; 3; 4]. We discuss the strategies to couple them. Finally, several numerical results are presented, illustrating the effectiveness of this approach.

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