Simulation of blood flow through large arteries by dimensional reduced models

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Mathematical models have become more and more important in many applications from medicine and biology, since they enable physiologists to study processes in the human body noninvasively. As an example, one could investigate the effect of compensation mechanisms for reduced blood flow like metabolic regulation and arteriogenesis [4, 5].

Besides a model for this application area, we outline in this talk, how the use of three-dimensional (3D) blood flow models and FSI-models can be circumvented by means of one-dimensional (1D) models [3, 6]. For the simulations, the 55 main arteries of the human body are considered. At the outlets of this network, 1D-models and lumped parameter models (0D) [2] are coupled to account for the influence of the omitted vessels. In addition to the addressed modeling issues, numerical discretization methods for the 1D- and 0D-models [1, 6] are presented. Finally, we discuss how kernel methods can be used to increase the efficiency of the numercial model [7].

References

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