This thesis is focused on study of blood flow through the descending aorta using magnetic resonance imaging and computational hemodynamics. This combination enables simulations of blood flow in patient specific geometries and under various circumstances such as higher heart rate, velocity or blood pressure.
The theoretical part describes the governing equations of the blood flow and possible choices of boundary conditions. The weak formulation and discretization in space and time, which leads to the finite element approximation, is presented.
The magnetic resonance data is presented in the second part. The process of segmentation is described together with the preparation of the velocity data for comparison with simulation results. Limitations of magnetic resonance imaging are also presented. The developed methodology is one of the contributions of this thesis.
The qualitative and quantitative comparison of simulation results and the magnetic resonance velocity data is presented in the third part. The main result of the thesis is in the comparison of the flow under different wall boundary conditions. The most important finding is that the best fit for the data is the free-slip wall boundary condition, which is the opposite of commonly used no-slip wall boundary condition.