Abstract:
The incompressible fluid flow around the geometries of cerebral artery aneurysms is studied in this thesis. The aneurysm is a local extension of a vessel. This disease is dangerous only in the case of rupture. Then the blood is released into the brain. The need of accurate computation of the velocity and pressure fields in this geometries is motivated exactly by the question which aneurysm has tendency to rupture.
The finite element method (FEM) is used for the computation of the flow. A good domain discretization is one of the main step in FEM. Modern computed tomography is able to produce series of the two-dimensional images and it is necessary to create an appropriate three-dimensional model of the tissue. This thesis includes the description of the mesh generation and the ways to smooth and improve the meshes.
In the theoretical part the equations of fluid flow are formulated. A suitability of a choice of boundary conditions is discussed. Weak formulation for the equations and its discretization are presented.
In the practical part velocity and pressure fields are computed by the various finite elements. Wall shear stress which plays an important role in the evolution of an aneurysm is also computed on the introduced meshes. Comparison of mesh smoothing filters, used finite elements and used programs is presented.