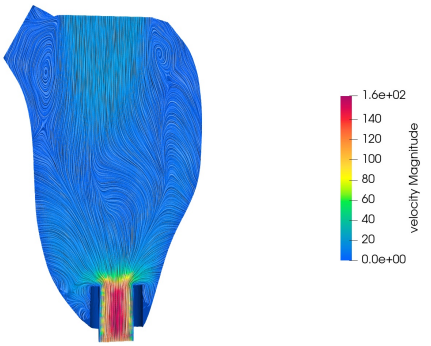
CHAIR FOR COMPUTATIONAL ANALYSIS OF TECHNICAL SYSTEMS

Master/Project/Seminar Thesis

for Students of Computer Science or CES, or Mechanical Engineering

Implementing a Viscoelastic Material Law for Heart Simulations with FEM and High Performance Computing

Based on a real biomedical application, we develop a comprehensive simulation of a human left ventricle for patients with a left ventricular assist device (LVAD). Patients with ventrical dilatation usually should only get this technology implanted as a bridge to transplant, but it is often used over a longer period than expected. To decrease blood damage caused by the LVAD, our simulation seekst to cover the left ventricle with the LVAD cannula in a static and dynamic case with different rotational speeds to increase the washout over multiple cycles.



We offer:

As of now, we are able to simulate the static ventricle with simple boundary conditions. We are now looking for ways to implement a moving ventricle. The most basic approach is to use a viscoelastic material law to model the behavior of the muscle tissue. As of now, our Fortran Finite Element Solver does have have a viscoelastic material model with time-dependency, but the framework to include such and to couple it to the fluid equations. The implementation and testing of the material law and coupling it to the fluid equations would be the core topic of this thesis.

Prerequisites:

We are looking for students with a strong coding background. Ideally, you are familiar with Fortran and the finite element method. If you have fun progamming and are interested in simulation and numerical methods, send me a short email with some info about yourself, and we'll meet up.

Contact: Maximilian Schuster, M.Sc., Schinkelstr. 2, room 224
E-Mail: schuster@cats.rwth-aachen.de