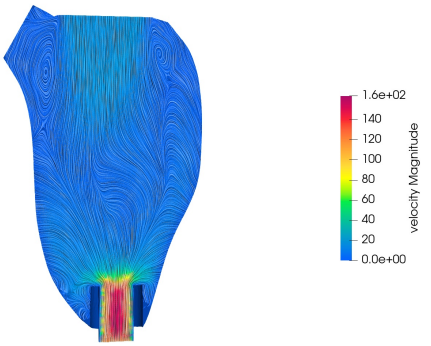
Lehrstuhl für Computergestützte Analyse Technischer Systeme | RWTH AACHEN UNIVERSITY

Master/Project/Seminar Thesis

for Students of Computer Science or CES, or Mechanical Engineering

Implementing a Variational Multiscale Method 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. The blood flow in the left ventricle takes place in the transition regime between laminar and turbulent flow. Therefore we are interested in implementing a turbulence model into our existing finite element solver. The method we have decided on is the Variational Multiscale Method (VMS) that combines stabilization and turbulence modeling in the style of Large Eddy Simulations (LES).

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.

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