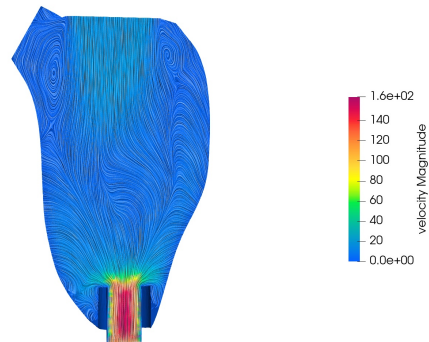


Master/Project/Seminar Thesis

for Students of Computer Science or CES, SiSc or Mechanical Engineering

Simulating the fluid inside the human left ventricle with a LVAD 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 ventricular 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 seeks 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. For the future, we wish to include more complex boundary conditions and movement patterns of the ventricle wall. We offer different topics for a thesis. One would be the coupling of our fluid solver to a ODE solver that is able to couple the boundaries of the domain and create a closed-loop-simulation. There is no such implementation for our code yet, so your code design could start from scratch. The other topic covers the coupling of the fluid solver to a structural solver. In the scope of this task, the ventricle wall should be modelled as an elastic material, that is able to be deformed isotropically according to a given volume-time-relation. Ideally, this also includes the non-moving part of the LVAD cannula.

Prerequisites:

You should be familiar with *Fortran* and Unix system. Experience with objected oriented programming and high performance computing will be needed, but can also be gathered here to a certain extent. Knowledge about the finite element method is a must. If you have fun coding and are interested in simulation and numerics, write me a short email with some info about yourself, and we'll meet up (probably digitally).

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