

Master's thesis proposal

Quantitative Benchmark Numerical Analysis of a Benchtop Aortic Valve Testing Model

Contact person: Massoud Rezavand, Bence Rochlitz:

rezavand@virtonomy.io, rochlitz@virtonomy.io

Project Abstract

This thesis aims at carrying out quantitative benchmark analysis to validate a computational framework based on the mesh-free Smoothed Particle Hydrodynamics (SPH) method for the simulation of the human aortic valve. Experimental and analytical datasets are going to be employed for this purpose and the validated model will ultimately demonstrate compliance with ISO standards for real-life applications.

Background and Motivation

Virtonomy GmbH is developing the first web platform for conducting fully data-driven clinical trials of medical devices with the use of virtual patients. Our system is based on clinical scans (CT, MRI), pathology data, and data about medical devices. Medical device simulation is one of the key features of our offering.



Figure 1: Virtonomy's web platform

Our choice of SPH enables interactive simulations for medical device developers and clinicians in our web platform. This thesis focuses on a use case of a benchtop aortic valve testing device.

Technical Prerequisites

Basic simulation background (FEM and/or SPH) and good C++ knowledge. Feel comfortable learning a new concept and working on a new framework.

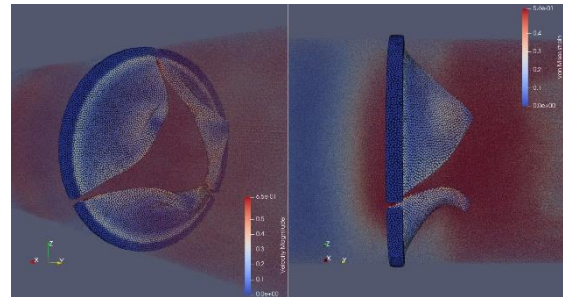


Figure 2: FSI simulation of the Aortic Heart Valve (Virtonomy GmbH)

Student's Tasks Description

- Collect the available validation methods and data from the literature
- Research on state-of-the-art simulation models for a benchtop aortic valve
- Adapt a simulation framework in C++ based on SPH and the anatomical and data provided by Virtonomy and literature
- Carry out a quantitative benchmark analysis
- Demonstrate the compliance of the model with the corresponding ISO standard

By the end of the project, the student shall have the following outcomes: a validated simulation model of a specific aortic valve that complies with the corresponding ISO standard. The student will learn the core concepts of SPH, how to apply them to a real-life problem, and validate the model. Virtonomy provides supervision with industrial simulation and software development experience.

Why you should choose us

- Opportunity to work in a vibrant environment with many other start-ups (Werk1) or from home (home office is 100% allowed)
- Participation in the exciting development and growth of a start-up
- Contributing to an exciting real-life medical data solution with a huge impact: your simulation model will be available for medical device developers and will help them streamline development, and reduce risk in animal/human trials