Chair for Computational Analysis of Technical Systems

RWTH AACHEN UNIVERSITY

Master thesis

for students of Mechanical Engineering, CES, SiSc, etc.

Continuum and agent-based models of in-stent restenosis

Coronary artery stenosis is commonly treated with stents, but a frequent complication is in-stent restenosis (ISR). ISR is driven by inflammation, which triggers a cascade of cellular activity in the arterial wall. There are two main approaches to modeling ISR: (1) continuum mechanics models, where cell species dynamics are described using advection-diffusion-reaction equations, and (2) agent-based models, which treat cell species as agents governed by stochastic processes and probability laws. Both methods have their advantages and limitations. In this thesis, you will explore how to compare these approaches and develop a framework for integrating them.

Your tasks:

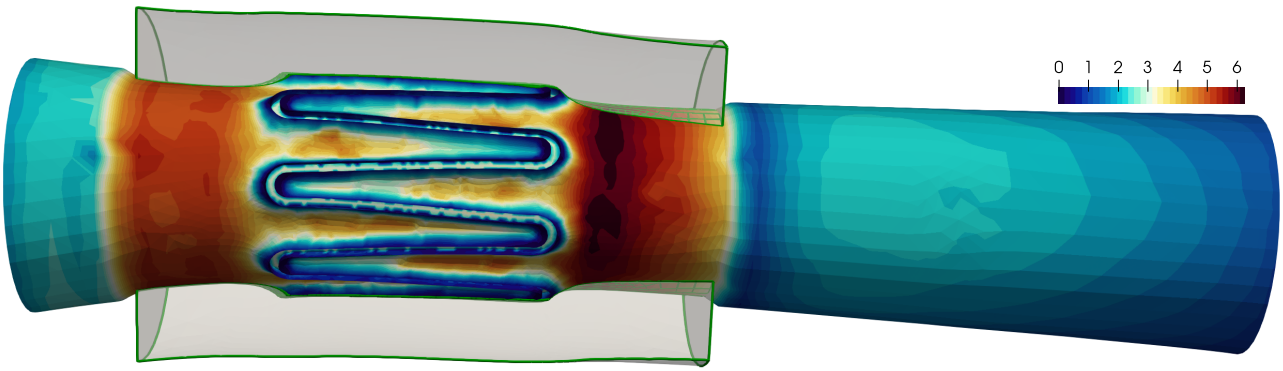
- Adapting an existing continuum mechanics framework to patient-specific geometries
- Learning about agent-based modeling in a cardiovascular application
- Developing a comparison framework between continuum and agent-based models

What we offer

You will have the opportunity to spend time as visiting student at Politecnico di Torino (Italy) and collaborate on part of you thesis with developers of the agent-based model. You will gain experience with various techniques for modeling biomechanical phenomena and learn how to compare different workflows in an international, collaborative environment. There is also the potential for a peer-reviewed publication.

Prerequisites

- Interest in computational modeling of biomedical applications
- Experience with finite element method and/or stochastic processes
- Programming skills, preferably in Python, Matlab or C++



Altered wall shear stress distribution 51 days after stent implantation due to ISR.

Contact: Anna Ranno, Schinkelstraße 2, Room 221
E-Mail: ranno@cats.rwth-aachen.de • Tel.: +49 241 80-99913