Chair of Computational Modeling and Simulation
TUM Department of Civil, Geo and Environmental Engineering
Technical University of Munich

Software Lab:

Modeling:
Mathematics:
Programming:
Science:

Interactive Simulation of Endoscopy in SPH

Description

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. Our web platform provides a device and use case-tailored simulation models for medical device developers to investigate dynamic tissue-device interaction.

This project aims at implementing a new simulation model for the development of endoscope devices and the training of physicians. The simulation framework is based on the mesh-free Smoothed Particle Hydrodynamics (SPH) method, implemented in C++. The simulation model will be integrated with our 3D Viewer, which medical device developers use for optimization of device design, fit, and deployment.
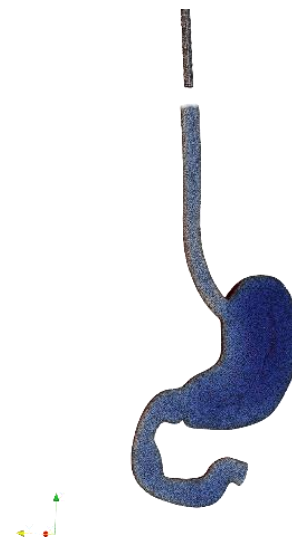
Figure 1.: Simulation setup of endoscopy in SPH

Task

Implement an endoscope simulation use case in SPH, where the user interactively controls the endoscope path:

- Get to know the SPH software and define the simulation model based on literature and anatomical considerations
- Implement the use case and new boundary conditions (e.g. target position and orientation of the endoscope)
- Implement a way to change the active boundary conditions during simulation run to allow interactive user input
- Compile the C++ simulation model to Webassembly (using our existing tool) and integrate with the frontend application in JavaScript, including updating the current software architecture

Supervisor

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References

https://www.sphinxsys.org/