Karlsruher Institut für Technologie

Institute of Biomedical Engineering

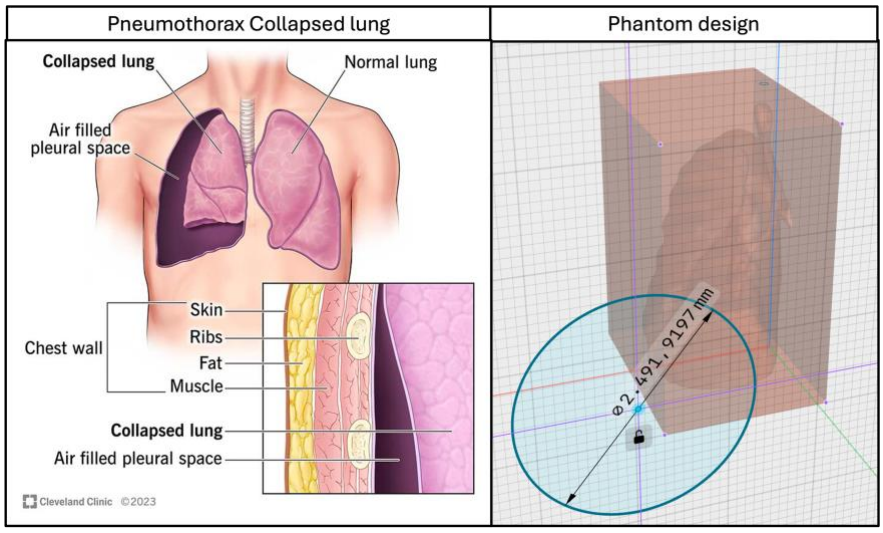
Master thesis

Development of a Biomechanical Lung Phantom for Surgical Simulation and Collapse Modeling

Motivation

Lung pathologies requiring surgical intervention demand advanced preoperative planning and simulation. The ability to replicate lung biomechanics realistically is crucial for improving surgical training, validating computational models, and testing medical devices. This Master's thesis focuses on developing a mechanical lung phantom that can simulate lung collapse, a critical aspect of various thoracic procedures. This research aims to bridge that gap by designing a phantom, integrating a pleural cavity where air can be insufflated to induce controlled lung collapse.
This phantom could provide a quantifiable, repeatable model to study lung deformation and validate computational simulations.
This phantom design should feature:

- A rigid thoracic cavity representing the pleural parietal layer.
- A soft, balloon-like inner pleura, filled with a material mimicking lung parenchyma.
- A pleural interspace with a lubricating gel.



Task

- 3D prototyping (CAD design)
- Prototype construction (3D printing, silicon injection molding, more..)
- Validation (measurements and assessment)

Requirements

- CAD designing

Good to have

- Moulding techniques
- Biomechanical basics

Field of research:
Surgical Simulation

Title of research project
Surgical dynamic organ simulations for surgical navigation

Program
3DSlicer – Blender

Course of study
Electrical engineering
Computer Science
Mechanical Engineering
Mechatronics
Physics

Starting date
Possible at any time

Contact
M.Sc. Domenico Riggio
Geb. 30.33, Raum 519
Fritz-Haber-Weg 1

76131 Karlsruhe

eMail:
domenico.riggio@kit.edu
Telephone:
+49 721 608-47183