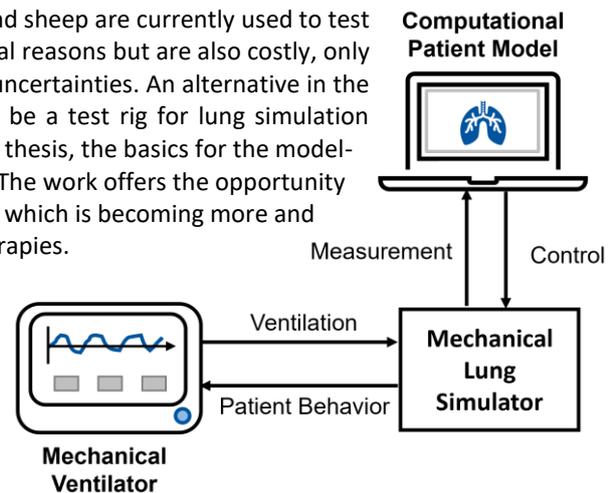


# Master Thesis

## Modular Model of the Cardiorespiratory System under Mechanical Ventilation

### Motivation

Animal experiments on large mammals such as pigs and sheep are currently used to test ventilators. These are not only to be avoided for ethical reasons but are also costly, only feasible to a limited extent, and subject to biological uncertainties. An alternative in the sense of the 3R principle by Russel and Burch could be a test rig for lung simulation controlled by a computer model of the patient. In this thesis, the basics for the model-driven control of such a test rig are to be worked out. The work offers the opportunity to gain in-depth knowledge of physiological modeling, which is becoming more and more important with the advance in model-based therapies.



### Tasks

The objective of this work is the conception and implementation of a model to represent the human cardiorespiratory system under artificial ventilation. A modular design is intended to enable both adaptations to different types of patients and time-efficient execution for real-time application. Tasks include in detail:

- ▶ Reviewing the literature on the state of the art of cardiorespiratory models
- ▶ Designing the modular model system: selecting the modules, defining inputs and outputs, and interfaces between modules
- ▶ Implementing the model in MATLAB SIMULINK
- ▶ Evaluating the designed model

### Prerequisites

- ▶ Ongoing master's studies in CES, Computer Science, Mechanical Engineering, or similar
- ▶ Independent working style and good analytical skills
- ▶ Affinity to mathematics, especially differential equations
- ▶ Interest and ideally prior knowledge in mathematical modeling, the cardiorespiratory system, and mechanical ventilation

### Our Offer

- ▶ Insights into interdisciplinary research at the interface of engineering, computer science, and medicine
- ▶ Once possible - pleasant working atmosphere on-site, fully automatic coffee machine, and regular social events in the biomedical engineering group
- ▶ Start immediately, or by appointment

### Contact

Do not hesitate to get in touch with me if you are interested in the project or the research topic in general. Please include in your application: CV, grade transcript, relevant certificates (optional)

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