

## Did the patient get better? Determine the health condition of patients in intensive care by using data-driven modelling.

When patients end up in intensive care, they are often subjected to artificial ventilation. In this case, it is important to be able to monitor the states of the patients' lungs, especially in the case of a lung disease (such as COVID).

In this thesis, we propose to use Respiratory Oscillometry (RO) to track the evolution of the state of the lungs. RO uses data-driven modelling techniques to identify the lung impedance by applying small pressure oscillations (i.e. *excitations*) onto the breathing or ventilation. Information about the respiratory mechanics can be extracted out of this impedance, including the resistance (R) and elastance (E) of the lung. At the ELEC department we implemented a novel RO protocol, using a customized multisine excitation signal, in two professional mechanical ventilator devices. After extensive testing and the regulatory approval, a clinical trial is going to be executed in the months June, July and August of 2023. This will give us a lot of data with a lot of potentially interesting information to discover.

The goal of the thesis is to identify statistically relevant parameter changes over multiple measurements of the same patient. The following subtasks can be identified:

- Data cleaning: before the flow and pressure measurements can be processed, they need to be cleaned. This includes removal of transients, removal of breathing artefacts (e.g. coughing).
- Signal processing: Before a parametric model can be estimated, a quality check needs to be performed.
- Data driven modelling: a parametric model will need to be estimated, starting from a first order model. Next, implement techniques to identify time varying behaviour of the model parameters.
- Statistics: Ensure that the time-variations are statistically relevant.
- Automate the data processing to execute the analysis of multiple patients efficiently

The student will be able to start on an existing code base.

