DESCRIPTION FOR THE GENERAL PUBLIC

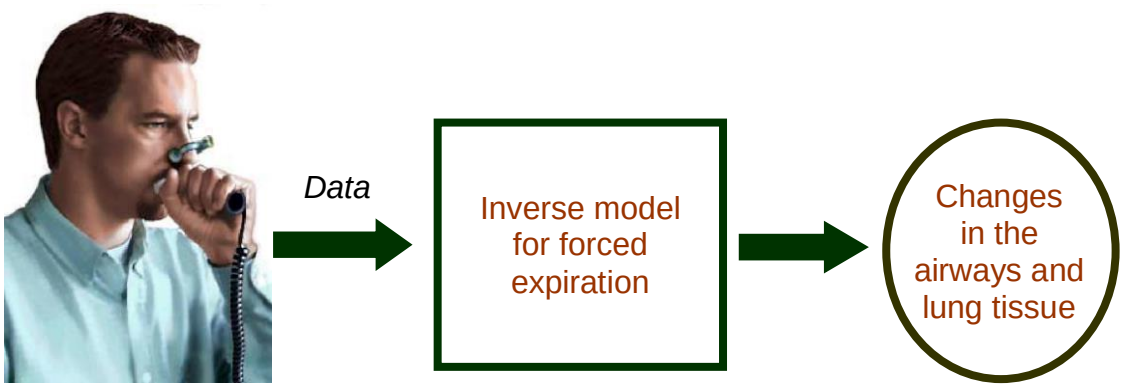
Reasons for choosing the research topic

The respiratory system is one of the most complex and essential human organs. This complexity is a source of serious difficulties in the study of its structure and function. The most common respiratory illnesses include asthma and chronic obstructive pulmonary disease (COPD). It is estimated that from 600-700 million people are affected worldwide, and in 2001 COPD was the 5th leading cause of death in high-income countries. In Poland, approximately 1,500 patients die from asthma and 15,000 from COPD every year. The development of these diseases is progressive, so their early detection and further monitoring is of great importance.

Forced expiratory manoeuvre is the most widely used test of lung function, characterised by high sensitivity and specificity of the recorded flow-volume curve (MEFV). The observed relationship between the intrinsic properties of the respiratory system and the shape of the MEFV curve raises the question whether it is possible to inferences quantitatively about the lung properties on the basis of forced expiratory data.

Objective of the project

The main objective of the project is to investigate the relationships between: the airways structure, changes in their mechanics, variations of lung tissue properties, and the flow-volume curve shape measured at the mouth outlet, as well as to use such knowledge in the elaboration, implementation and validation of the method for monitoring developments within the airways of persons suffering from chronic respiratory diseases, seen as a systematic evolution of the MEFV curve.



The underlying research hypotheses says that it is possible to detect, localise and identify the relative character of developments within the airways using the physico-mathematical model for the respiratory system during forced expiration, the techniques of regularised estimation of non-linear model parameters, and the data from two successive spirometry tests.

Research to be carried out

The planned activities were divided into six following tasks:

1) Adaptation of own-elaborated computational models for forced expiration to project purposes;
2) Elaboration of the identifiable inverse model for forced expiration from homogeneous lungs;
3) Elaboration and implementation of the method for the estimation of inverse model parameters;
4) Elaboration and implementation of the method for the identification of relative developments within the airways using data from two successive spirometry tests;
5) Evaluation of the method for monitoring developments within the airways using synthetic data generated with the computational models for forced expiration;
6) Evaluation of the method for monitoring developments within the airways using experimental data from bronchodilation tests conducted in patients suffering from asthma and COPD.