Faculty Science and Technology
Program Biomedical Engineering

UNIVERSITY OF TWENTE.

COLLOQUIUM

Group: **Engineering Fluid Dynamics**

As part of her Bachelor assignment

T.C.G. van Veluwen

will give a presentation, entitled:

In Vitro Modeling and Measuring of Collapsible Tubes in the Human Lung

Date: Tuesday October 7, 2014

Time: 16:00

Room: Horst Building Room N.109

Summary:
To measure the condition of a human lung a patient has to inhale and exhale fast and maximally and the results are standard depicted in a so called flow-volume curve (spirometry).
During the forced expiration, the conducting airways in the upper part of the lungs collapse due to an increased pressure around them which is caused by contraction of the diaphragm and the muscles of the chest. This airway collapse occurs in both healthy and diseased lungs, but is more severe in people suffering from lung diseases such as chronic obstructive pulmonary disease (COPD) and asthma. In the flow-volume curve the onset of flow limitation during expiration therefore arises sooner and is more severe when lung diseases are present which alter the elastic properties of the airway walls.

To investigate the collapse of the airways, elastic tubes are used. These tubes buckle when subjected to an external pressure. Typically, these experiments are performed by using a Starling Resistor which is a closed chamber around an elastic tube in which the pressure can be regulated. Earlier experiments conducted with this Starling Resistor consisted of inducing a regulated airflow through such a tube. The present study focuses on the development of a Starling Resistor to model and measure collapsibility of elastic tubes.

The study is divided into two parts: buckling of collapsible tubes under varying transmural pressures without air flow through the tube, and buckling of these tubes with air flow through the tube. The fluid-structure interaction between the fluid and solid mechanics are coupled using the tube law. First, the tube law is simulated using the Starling Resistor. Next, dimensional analysis is used to analyse the influence of different tube dimensions, wall elasticity and different transmural pressure and the results are used to simulate the human airways during a forced expiration.

Assessment committee:

Prof.dr.ir. H.W.M. Hoeijmakers	(Chairman)
Dr.ir. F.H.C. de Jongh	(Mentor)
E. Oppersma MSc	(external member)
Dr.ir. R. Hagmeijer	

Chairman,

d.d. 22-09-2014