



Subdepartment **Engineering Fluid Dynamics - CTW**
Department **Mechanical Engineering**

As part of his / her masterassignment

Mathias Pecher

will hold a speech entitled:

Particle Deposition in Pulmonary Flow

Date: 04-12-2015

Time: 10:00 hr

Room: N109

Summary:

This paper is dedicated to see if dispersed particles inside the human lungs for a laminar, fully developed flow could be modelled by an analytical approach. For this purpose the Weibel-A model is adopted, which simplifies the geometrical form of lung generations without alveoli to cylindrical, smooth, rigid tubes. The equation of motion for spherical, solid particles in an incompressible flow is simplified such that only the inertial and gravitational forces are retained. The behaviour of the particles is studied assuming two flow profiles - the Hagen-Poiseuille flow and the uniform flow - which reasonably represent the flow conditions inside the lungs. The equation of motion as well as the flow equations are then subjected to a dimensional analysis where the characteristic parameters that completely describe the present problem are found. Furthermore the analytical solutions for the position, velocity and acceleration equation of the particle are calculated. Afterwards these equations are solved by the use of a numerical program written in FORTRAN. The algorithm makes use of the common and modified Newton-Raphson method to solve the equations of motion for predetermined airway generations. The deposition efficiency of particles inside a cylindrical tube can be predicted by the ratio of the Stokes number (St) and Froude number (Fr) for a fixed aspect ratio (L/R).

Assessment committee:

Prof.dr.ir. C.H. Venner
Dr.ir. R. Hagmeijer
Dr.ir. P.C. Roos
Dr.ir. N.P. Kruyt

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d.d.