

CEMRACS '08

Modelling and Numerical Simulation of Complex Fluids
21st July - 29th August 2008, Marseille, France

Numerical modelling of the respiratory tract

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Among all systems in medical modeling, the respiratory one certainly holds a pole position for complexity. Breathing involves gas transport through the respiratory tract with its visible ends, nose and mouth. Air then streams from the pharynx down to the trachea. The trachea extends from the neck into the thorax, where it divides into right and left main bronchi, which enter the corresponding lungs. The inhaled air is then convected in the fractal bronchus tree which ends in the alveoli embedded in a viscoelastic tissue, made in particular of blood capillaries, and where gaseous exchange occurs.

A numerical lung would certainly be very helpful in the understanding of some of the deceases and a way to guide the intuition for curative gestures. But, from the computational point of view it is not affordable to describe the whole respiratory system keeping the same level of details. The subject is thus to improve the multiscale strategies developed in the PhD thesis of A. Soualah (Univ. Orsay) to model the airflow in respiratory tracts by designing efficient algorithms adapted to the model (in particular we propose to test a POD strategy).