

Li, Yuan, MEng., Modelling of particle flow during powdered drug inhalation, The University of Western Ontario, December 2005 (co-supervised, with C Zhang).

Abstract

A physically 3D representation of human mouth-laryngeal part and five upper generations of bronchi parts is studied to find out the flow and particle deposition patterns in human airway. Computational fluid dynamics (CFD) simulations of airflow and particle deposition in lung model were conducted. The airflow field is obtained by solving three-dimensional Navier - Stokes equation with the standard k-e turbulence model and standard wall function. The Lagrangian reference frame is used to predict the trajectories of the solid particles. A one way coupled, stochastic model is used to model the influence of turbulence on particle trajectories. The Power Law method is used to discrete the transport equations. A segregated, implicit, steady and three dimension solver is used for the simulations. The study shows that ultrafine particles, the local airflow velocity are the dominant factor affecting the local deposition of the particles on the wall, while mass flow rate of the particle have only minor effect.