CFD Modeling and Analysis of Pulmonary Airways/Particles Transport and Deposition

Unsteady numerical simulations of air flow, mixed with micron particles, through a human lung conducting zone during inhalation have been performed. The process included importing images from a high resolution CT-Scan into a CFD software, generation of the CFD model and then CFD simulation over a 4 seconds cycle (2 seconds for inhalation and 2 seconds for exhalation). The inlet diameter was 11 mm and the flow rates were 5, 7.5, and 15 liters/ min. Only results for the highest flow rate are presented. The implicit-unsteady Reynolds Average Navier-Stokes equations with the Wilcox K-? turbulence model were used for the simulation. The micron particles were solid round coal with 1000 Kg/m3 density. Results indicate high correlation between regions of high vorticity and secondary flow and particle deposits. This was mostly evident in the main bronchus. While most particles should exit the lung during the exhalation process, however, areas of re-circulating flow and near the walls continue to have some particle deposits.

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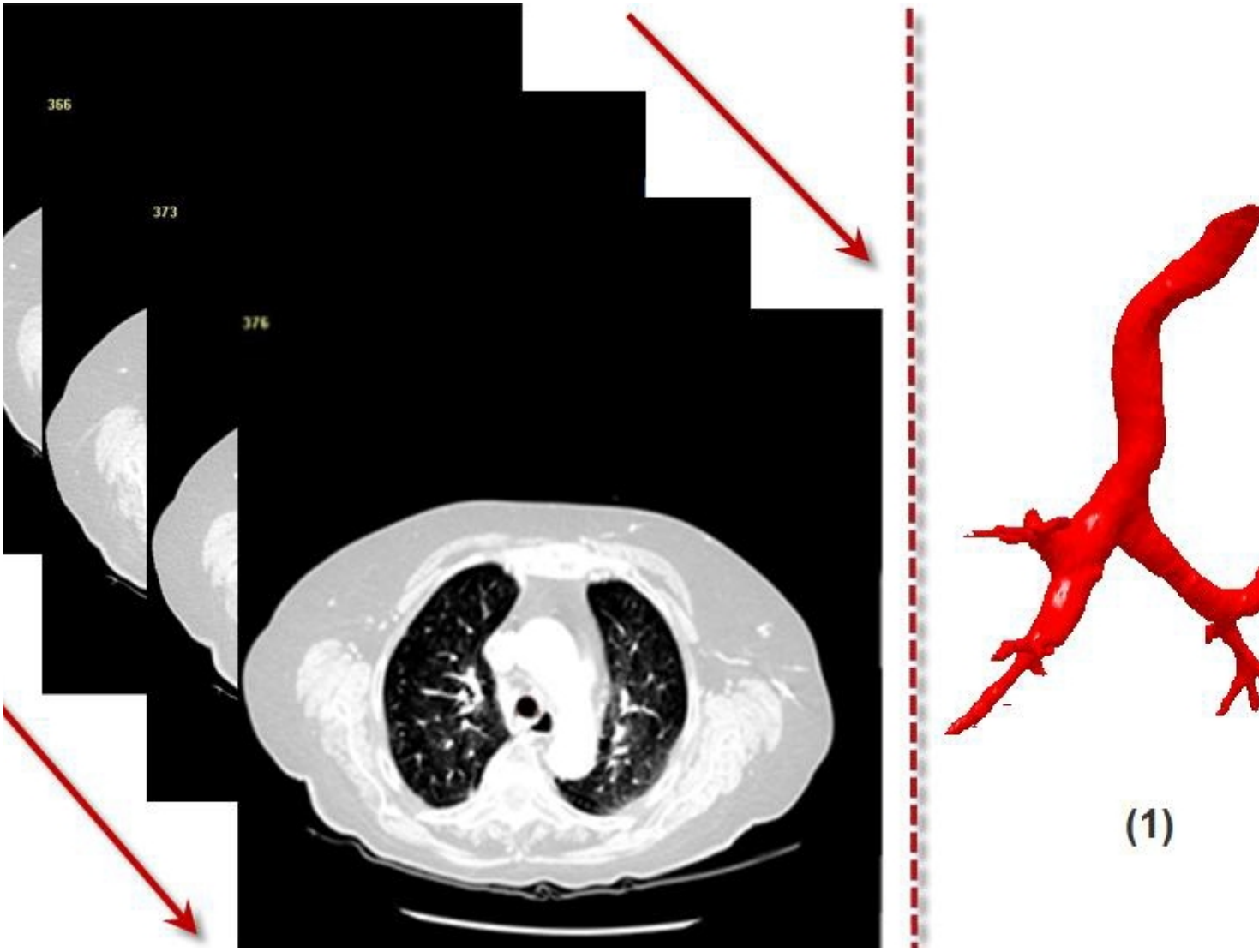

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