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CFD simulations of a deforming human lung using dynamic and static CT images[1] SHINJIRO MIYAWAKI, ERIC A. HOFFMAN, CHING-LONG LIN, The University of Iowa — The authors have developed a CFD model to simulate airflow in deforming lungs using dynamic (4D) CT images. After obtaining the surface mesh for one CT image, we deformed the surface mesh to match other CT images using an image registration technique. During the CFD simulations, we deformed the surface mesh by cubic interpolation as a function of lung volume, and deformed the volume mesh using a computational solid mechanics-based algorithm. To investigate the effect of CT scanning method and relative hysteresis with respect to lung volume on pressure drop along the central airways, we performed CFD simulations using different numbers of 4D and static CT images of one healthy subject. Based on the simulation with 13 4DCT images, we found that air flow fractions in airways remain nearly constant over time. By comparing the simulations with 13, 2, and 1 4DCT images, we found that the overall effect of relative hysteresis of lung structure on pressure drop along each branch at peak inspiration was 12%, and the effect of deformation was 16%. As a result of the comparison between simulations with 2 and 1 of 4D and static CT images, the effect of CT scanning method was 16-39%, depending on the deformation of the lung.

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