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Comparison of Air flow in CT-Based Rigid and Flexible Human Airway Models[1] GUOHUA XIA, Dept. of Mech. and Industrial Engr. , IIHR-Hydroscience & Engr., Univ. of Iowa, CHING-LONG LIN, Dept. of Mech. and Industrial Engr., IIHR-Hydroscience & Engr., Univ. of Iowa, MERRYN H. TAWHAI, Bioengineering Inst., Univ. of Auckland, ERIC A. HOFFMAN, Dept. of Biomedical Engr., Medicine and Radiology, Univ. of Iowa — The air flow characteristics in a CT-based human airway bifurcation with rigid and flexible walls are investigated numerically. An in-house 3D fluid-structure interaction solver is applied to simulate the flow at different Reynolds number and airway wall stiffness. For the flexible wall case, the bending curvature at bifurcation increases with softening wall stiffness during inspiration phase, resulting in enhanced secondary flow motion and velocity skewedness. As the Reynolds number increases, the airway wall deformation increases and the secondary flow becomes more prominent. It is also found that the fluid shear stress on the rigid airway wall is stronger than that on the flexible airway wall. It implies that the formation of fibrosis in the lungs, which hardens the airway wall and restrains the airway motion, has a tendency to increase wall shear stress and subsequently damage the lung tissue.

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Guohua Xia
Dept. of Mech. and Industrial Engr., IIHR-Hydroscience & Engr., Univ. of Iowa

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