Abstract Submitted
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Direct Numerical Simulation of the Flow in the Human Upper Airway[1] YONG WANG, SAID ELGHOBASHI, University of California, Irvine — The objective of our study is to understand the flow details in the critical zones inside the human upper airway (HUA) to minimize the guess work in performing surgeries for removing flow obstructions. The 3D flow in HUA consists of unsteady laminar, transitional and turbulent regimes. We perform DNS of HUA flow using lattice Boltzmann method (LBM). We validated our DNS- LBM via comparisons with other DNS methods and experiments for several canonical flows. Excellent agreement was achieved for 3D turbulent channel flow of Kim et al. (JFM 1987) and experimental data for 3D flows in curved pipes. Our predictions of the flow in an idealized HUA model agree well with the experimental data. We predict the flow in a real HUA whose geometry is reconstructed from optical coherence tomography (OCT) data. Both inspiration and expiration cases with various inflow rates are studied. Velocity, pressure and shear stress distributions, time-dependent trajectories of tracer particles and instantaneous streamlines throughout the domain are presented.

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