Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

DNS and PIV Measurements of the Flow in a Model of the Human Upper Airway[1] YONG WANG, Univ of California - Irvine, LIRAN OREN, EPHARIM GUTMARK, Univ. of Cincinnati, Cincinnati, OH 45267, SAID ELGHOBASHI, Univ of California - Irvine, UNIVERSITY OF CALIFORNIA, IRVINE COLLABORATION, UNIV. OF CINCINNATI, CINCINNATI COLLABORATION — The flow in the human upper airway (HUA) is 3D, unsteady, undergoes transition from laminar to turbulent, and reverses its main direction about every two seconds. In order to enhance the understanding of the flow properties, both numerical and experimental studies are needed. In the present study, DNS results of the flow in a patient-specific model of HUA are compared with experimental data. The DNS solver uses the lattice Boltzmann method which was validated [1] for some canonical laminar and turbulent flows The experimental model was constructed from transparent silicone using a mold prepared by 3D printing. Velocity measurements were performed via high speed particle image velocimetry (HSPIV). The refractive index of the fluid used in the HUA experimental model matched the refractive index of the silicone. Both inspiration and expiration cases with several flow rates in the HUA are studied. The DNS velocity fields at several cross section planes are compared with the HSPIV measurements. The computed pressure and vorticity distributions will be also presented.

[1] Y. Wang & S. Elghobashi, (2014). Respir Physiol Neurobiol., 193, 1–10.

[1]NIH Heart Lung and Blood Inst.-Grant HL105215

S. Elghobashi
Univ of California - Irvine

Date submitted: 31 Jul 2014 Electronic form version 1.4