Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Towards numerical simulations of fluid-structure interactions for investigation of obstructive sleep apnea CHIEN-JUNG HUANG, SUSAN M. WHITE, SHAO-CHING HUANG, SANJAY MALLYA, JEFF D. ELDREDGE, Univ of California - Los Angeles — Obstructive sleep apnea(OSA) is a medical condition characterized by repetitive partial or complete occlusion of the airway during sleep. The soft tissues in the airway of OSA patients are prone to collapse under the low pressure loads incurred during breathing. The numerical simulation with patient-specific upper airway model can provide assistance for diagnosis and treatment assessment. The eventual goal of this research is the development of numerical tool for air-tissue interactions in the upper airway of patients with OSA. This tool is expected to capture collapse of the airway in respiratory flow conditions, as well as the effects of various treatment protocols. Here, we present our ongoing progress toward this goal. A sharp-interface embedded boundary method is used on Cartesian grids for resolving the air-tissue interface in the complex patient-specific airway geometries. For the structure simulation, a cut-cell FEM is used. Non-linear Green strains are used for properly resolving the large tissue displacements in the soft palate structures. The fluid and structure solvers are strongly coupled. Preliminary results will be shown, including flow simulation inside the 3D rigid upper airway of patients with OSA, and several validation problem for the fluid-structure coupling.

Chien-Jung Huang
Univ of California - Los Angeles

Date submitted: 01 Aug 2014 Electronic form version 1.4