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Development of New Boundary Conditions for Flow in Human Airways VICTOR MARRERO, KENNETH JANSEN, Rensselaer Polytechnic Institute — During recent years much effort has been centered on modeling different aspects of the Human Respiratory System (HRS). Obtaining an accurate description of the structure of the HRS and accurate boundary conditions have been some of the biggest challenges to date in this field. Most of the current CFD models available in the literature focus their attention mainly in the conducting airway zone and make use of a velocity profile boundary condition in the model inlet to emulate the inhalation, and/or exhalation process. While this approach has been used successfully for cardiovascular flows (where the flow rate remains positive over the entire cycle) it is suspect and formally ill posed for flows within the HRS where half of the cycle experiences negative flow rate. To be able to represent more realistic physiological mechanics of the fluid flow in the HRS, new boundary conditions must be developed to more properly account for the oscillatory flow rate. We have developed a constant pressure inlet/outlet boundary conditions as well as deforming outlet boundary conditions (e.g. moving mesh) to produce oscillatory flow within the respiratory system model. Since air behaves as an incompressible fluid in the HRS, as the mesh deforms in an oscillatory manner, an oscillatory flow rate is induced. The simplest version of this approach is akin to a piston-cylinder arrangement with the outlet face being the piston surface.

Victor Marrero
Rensselaer Polytechnic Institute

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