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Novel immersed boundary method for fluid-structure interaction of compressible flow

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The geometry of the human upper airways is complex, and parts of it are bounded by soft tissue. Mathematical modelling of the airflow through the deformable parts of the airway is challenging due to the two-way fluid-structure interaction, large deformations, and multitude of length- and timescales involved.

A novel, three-dimensional immersed boundary method is being developed, to simulate the airflow in the airways of patients who suffer from obstructive sleep apnea (OSA). The fluid-structure interaction is simulated with a partitioned approach, where the displacements of the solid boundaries and the forces from the fluid are updated at every time step. The method will be tested for benchmark cases. The final goal is to use the method to simulate realistic, patient specific airway geometries from OSA patients.