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Interfacial distribution of mucus under forced expiration in a double bifurcation model RAHUL RAJENDRAN, ARINDAM BANERJEE, Lehigh University — Mucus is removed from the lung airways by the rhythmic beating of cilia and the mucus interaction with the turbulent core airflow generated during a cough or forced expiration. The quantity and quality of mucus are adversely altered, impairing mucociliary clearance under chronic pulmonary conditions. Existing studies on airflow induced mucus clearance have established a functional relationship between the airflow rate, mucus properties, flow bias, breathing frequency and clearance; however, the impact of airway branching, gravity, and characterization of primary and secondary flows have not been studied. The focus of the current investigation is the detailed understanding of air-mucus two-phase flow mechanism under steady expiratory airflow in a double bifurcation model. The effect of different airflow rates and mucus viscosities on the flow morphology, mucus layer thickness, mucus clearance and pressure drop across the model will be discussed. The impact of in-plane and out-of-plane configurations of the bifurcation model on the primary and secondary flow structures as well as the mucus distribution will be addressed. In addition, a detailed comparison of the flow structures in the mucus-lined airways, and its corresponding dry wall (no mucus lining) case will be presented.

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