

AIR-MUCUS INTERACTION IN A PULMONARY AIRWAY: A PERSPECTIVE OF A PROCESS
ENGINEER

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A hybrid approach based on computational fluid dynamics (CFD) and lumped parameter-based modeling (LPM) is used to understand the comprehensive role of air-mucus interaction flow in the pulmonary airway. The mucus is modeled as Bingham fluid which can either acts as (1) partially fluid and partially liquid; (2) purely liquid and (3) purely solid. An equivalent impedance is derived that depends on the airway geometry, yield stress, and fluid parameters. It is observed that gravity plays a significant role in the transportation of mucus which is essential in airway clearance techniques, especially in case of respiratory diseases like asthma, COPD, cystic fibrosis, etc. where mucus is over-secreted. The derived impedance provides clear insights into the mucus over secretion.

Joint work with Benjamin Mauroy (University Côte d'Azur, France).