Abstract Submitted
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Alveolar mechanics using realistic acinar models[1] HARIBALAN KUMAR, CHING-LONG LIN, Department of Mechanical and Industrial Engineering, The University of Iowa, MERRYN H. TAWHAI, Auckland Bioengineering Institute, The University of Auckland, ERIC A. HOFFMAN, Department of Radiology, Physiology, and Biomedical Engineering, The University of Iowa — Accurate modeling of the mechanics in terminal airspaces of the lung is desirable for study of particle transport and pathology. The flow in the acinar region is traditionally studied by employing prescribed boundary conditions to represent rhythmic breathing and volumetric expansion. Conventional models utilize simplified spherical or polygonal units to represent the alveolar duct and sac. Accurate prediction of flow and transport characteristics may require geometries reconstructed from CT-based images and serve to understand the importance of physiologically realistic representation of the acinus. In this effort, we present a stabilized finite element framework, supplemented with appropriate boundary conditions at the alveolar mouth and septal borders for simulation of the alveolar mechanics and the resulting airflow. Results of material advection based on Lagrangian tracking are presented to complete the study of transport and compare the results with simplified acinar models. The current formulation provides improved understanding and realization of a dynamic framework for parenchymal mechanics with incorporation of alveolar pressure and traction stresses.

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Ching-Long Lin
The university of Iowa

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