Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Numerical study of oscillating non-Newtonian flows, application to a pulmonary airway clearance device.[1] ANTOINE GALKO, SIMON GSELL, UMBERTO D'ORTONA, Aix-Marseille Univ., CNRS, Centrale Marseille, M2P2, Marseille, France, LAURENT MORIN, Physio-Assist Medical Affairs Director, JULIEN FAVIER, Aix-Marseille Univ., CNRS, Centrale Marseille, M2P2, Marseille, France — Chronic respiratory diseases are responsible for an increasing number of deaths due to the deterioration of air quality in industrialized countries. To help patients suffering from these diseases, which in most cases produce an excess of mucus (severe asthma or cystic fibrosis), the use of external devices like Simeox can be recommended. This device produces pressure waves inside the bronchial tree to help to expectorate mucus more easily, and improving the actual comprehension of the mechanisms at play to enhance this expectoration is crucial. In this perspective, a numerical study of pulsated forcing of a 2D idealized bronchus filled with a non-Newtonian fluid has been performed. The Lattice Boltzmann method is used to solve the flow. The non-Newtonian behavior of the fluid is modeled by a Herschel-Bulkley law, taking into account two properties: shear-thinning/thickening and yield stress. A parametric study based on three types of signals, as well as on the variation of the 4 non-dimensional numbers governing the flow is carried out.

[1]A.G. acknowledges the financial support of ANRT and Physio-Assist through the CIFRE grant 2018/0982

Antoine Galko
Aix-Marseille Univ., CNRS, Centrale Marseille, M2P2, Marseille, France

Date submitted: 31 Jul 2020 Electronic form version 1.4