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A dynamical systems approach to particle transport in lung airways ALI FARGHADAN, Northern Arizona University, FILIPPO COLETTI, University of Minnesota, AMIRHOSSEIN ARZANI, Northern Arizona University — Computer modeling of respiratory flows and particle transport are of both physiological and toxicological interests. In this talk, we present hidden dynamical systems features that control transport in human conducting airways. High-resolution computational fluid dynamics (CFD) simulation is carried out for an image-based tracheobronchial model under sinusoidal respiration flow. The destination map, which synchronizes the particle destination on the release point is found after performing Lagrangian particle tracking for microparticles. Finite-time Lyapunov exponent (FTLE) is calculated and inertial Lagrangian coherent structures (ILCS) are tracked during the breathing cycle. The results show that these dynamical systems features control the spatiotemporal evolution of the destination map at the trachea. Finally, slow manifolds are used as an efficient technique to identify the source of any arbitrary particle with backward integration of the Maxey-Riley equation. The novel dynamical systems techniques presented have important implications for drug delivery in respiratory disease.

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