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Leveraging theory from cosmodynamics to study the the effect of the pulsating heart on coronary arteries in a large-scale Lattice Boltzmann simulation AMANDA PETERS, Harvard University, SIMONE MELCHIONNA, JONAS LATT, EPFL, SAURO SUCCI, Consiglio Nazionale delle Ricerche, EFTHIMIOS KAXIRAS, Harvard University — We present a computational method for the simulation of cardiovascular flows in realistic human geometries derived from computed tomography angiography (CTA) data. The simulation is based on the Lattice Boltzmann method to model the blood flow in large-scale arterial systems and extends previously published studies using static geometries to include the effect of the pulsating heart on the coronary arteries. We provide here the derivation for introducing the deformational forces exerted on the arterial flows from the movement of the heart by borrowing concepts from cosmodynamics. The deformational forces are then cast into the kinetic formalism by using a Gauss-Hermite projection procedure. In this presentation, we will discuss this method as well as provide an analysis of the impact of these additional forces on the endothelial shear stress, a quantity associated with the localization and progression of heart diseases like atherosclerosis.

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