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A 2D multiring model of blood flow in elastic arteries ARTHUR GHIGO, PIERRE-YVES LAGRÉE, JOSE-MARIA FULLANA, Sorbonne Universités, CNRS and UPMC Université Paris 06, UMR 7190, Institut Jean Le Rond ∂'Alembert — Three-dimensional simulations of blood flow in elastic arteries are difficult and costly due to the complex fluid-structure interactions between the motion of the fluid and the displacement of the wall. We propose a two-dimensional multiring model to overcome those difficulties and obtain at a reasonable computational cost an asymptotically valid description of blood flow in large elastic arteries. The multiring equations are derived by integrating over concentric rings of fluid a simplified system of equations based on a long wave approximation of the axisymmetric Navier-Stokes equations and a thin-cylinder description of the arterial wall. Contrary to classical one-dimensional models, obtained by integrating the same system over a single ring, the multiring model computes the velocity profile as well as the wall shear stress and requires no a priori estimation of model coefficients. We show that by numerically solving the multiring system of equations, we are able to compute a large range of classical blood flow solutions, ranging from the elastic Womersley solution to the rigid tube Poiseuille solution.

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