Development of Two Novel Models for Arterial Blood Flow

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Abstract :

A critical aspect of arterial blood flow dynamics modeling involves deriving rapid and precise models capable of effectively capturing pressure and artery deformation. Achieving such models necessitates techniques such as asymptotic development and dimension reduction.
In this study, we unveil two innovative models tailored for arterial blood flow dynamics. Firstly, we derive a new one-dimensional model from the Navier-Stokes equations with non-Dirichlet boundary conditions resulting in an advection-diffusion problem. We then introduce a numerical approach based on the IIPG (Incomplete Interior Penalty Galerkin) and RKDG (Runge-Kutta Discontinuous Galerkin) methods for handling parabolic and hyperbolic partial differential equations.
Subsequently, we introduce a two-dimensional model for blood flow, utilizing similar techniques but eliminating the assumption of axisymmetry. This two-dimensional model accounts for arterial curvature and non-circular cross-sections, aiming for a more comprehensive representation of real-world arterial geometries.