

Exact Riemann solution for two-layered blood flow model in collapsible tube: artery

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ABSTRACT

This study provides the Riemann problem two-layered blood flow model with varying velocities and equal constant density in artery which is expressed by a set of quasi-linear partial differential equations. By thoroughly investigating characteristic fields and discussing the fundamental waves, including shock wave, rarefaction wave, and contact discontinuity wave, we arrive at an exact solution to the Riemann problem. The concerned system is transformed into two nonlinear algebraic equations with two unknown cross-sectional areas adjacent to the middle characteristic field by using the equality of velocity and pressure across the middle characteristic field. With several examples of initial data inspired from the literature, the Newton-Raphson method with two variables is used to determine the unknowns. Additionally, a graphical illustration of the exact solution for the physical parameters is demonstrated.

Keyword: *blood flow model, Riemann problem, elementary waves, numerical simulations*