Application of the Modified Method of Simplest Equation for Obtaining Exact Analytical Solutions for a Class of Nonlinear Evolution Equations Arising in Arterial Mechanics

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In this work, we study two kinds of nonlinear evolution equations (NLEEs) with variable coefficients for propagation of nonlinear waves in blood-filled unhealthy arteries. These equations are derived by a reductive perturbation method, and considering the human artery as a long thin–walled, prestressed hyperelastic tube with an axially symmetric imperfection (stenosis or aneurysm), and the blood as an incompressible viscous fluid. Depending on the kind of blood viscosity, the extended perturbed Korteweg-de Vries (KdV) (at constant viscosity) and extended KdV Burgers (at variable viscosity) equations with variable coefficients are considered. By employing an appropriate coordinate transformation we reduce the variable coefficient NLEEs to NLEEs with constant coefficients. Exact traveling–wave solutions of these equations are derived by applying the modified method of simplest equation, as the equation of Riccati is used as simplest equation. These solutions are illustrated numerically and the difference in wave propagation curves for the two kinds of NLEEs are analyzed and discussed in dependence on the blood viscosity type.

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