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An Efficient Algorithm for Computing Physiological Fluid Flows

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— A new, efficient algorithm is presented for solving the one-dimensional model equations for internal physiological fluid flows. The models equations are a set of coupled, 1D nonlinear partial differential equations that govern the evolution of the pressure, velocity, and cross sectional area in internal biological fluid flows. The solution algorithm for these equations, the pulsed flow algorithm (PFA), begins with a partial asymptotic solution of the discretized model equations, then combines the equations and linearizes them, reducing them to tridiagonal form. The algorithm is applied to blood flow computations in the human arterial system and is compared to the most commonly used method for solving the model equations, the Lax-Wendroff (LW) scheme. The PFA algorithm is found to be approximately 40 times faster than LW for a single arterial segment, and approximately 6 times faster than LW for a model of the human arterial tree that includes the 55 largest arteries.

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