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Title: An entropy stable and well-balanced scheme for an augmented blood flow model with variable geometrical and mechanical properties

Abstract. The flow of blood through a vessel can be described by a hyperbolic system of balance equations for the cross-sectional area and averaged velocity as functions of axial spatial position and time. The variable arterial wall rigidity and the equilibrium cross-sectional area are incorporated within the so-called tube law that gives rise to an internal pressure term. This system can be written as a conservative hyperbolic system for five unknowns. An entropy stable scheme for this augmented one-dimensional blood flow model is developed based on an entropy conservative numerical flux. It is proved that the proposed scheme is well-balanced in the sense that it preserves both trivial (zero velocity) and non-trivial (non-zero velocity) steady-state solutions. Several demanding numerical tests show that the scheme can handle various kinds of shocks and preserves stationary solutions when geometrical and mechanical properties of the vessel are variable. The authors acknowledge support by ANID (Chile) through projects Fondecyt 1250676, Centro de Modelamiento Matemático (CMM; project BASAL FB210005) and CRHIAM, project ANID/Fondap/1523A0001.