Non-isothermal viscoelastic flows with conservation laws and relaxation

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We propose a system of balance laws for non-isothermal viscoelastic flows of Maxwell fluids. The system is an extension of the polyconvex elastodynamics of hyperelastic bodies using additional structure variables. We establish a strictly convex mathematical entropy to show that the proposed system is symmetrizable and, as a consequence, we obtain the short-time existence and uniqueness of smooth solutions which define genuinely causal viscoelastic flows with waves propagating at finite speed. To model heat-conductors the system is complemented by the hyperbolic Maxwell–Cattaneo heat conduction law.