Significance & Novelty (revised)

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The GPR model of continuum mechanics has been purported to represent an alternative formulation to describe both fluids and solids within the same hyperbolic system of differential equations. There are many potential benefits to this. From a practical perspective, the potential ramifications of this include: the simplification of software made for the simulation of phenomena involving different states of matter; and the use of the vast array of effective numerical solvers designed for first-order hyperbolic systems. From a theoretical perspective, an advantage of the GPR model is that it cannot produce waves of infinite speed, unlike the parabolic Navier-Stokes equations. Additionally, the first-principles derivation of the mechanism by which viscous effects appear under the GPR model has been commented to be more appropriate than the more phenomenological viscous law appearing in the traditional Navier-Stokes formulation

This paper presents a method for modeling non- Newtonian fluids (dilatants and pseudoplastics) by a power law under the GPR model, along with a new numerical scheme for solving this system. The scheme is also modified to solve the corresponding system for power-law elastoplastic solids. This broadens significantly the range of problems that the GPR model can be applied to, from both a theoretical and a practical perspective.