

# The mechanics and mathematics of bodies described by implicit constitutive equations

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After discussing the rationale and the need for the development of implicit constitutive relations, both from philosophical and pragmatic viewpoints, to describe the response of both non-linear fluids and solids, I will discuss applications wherein they can be gainfully exploited. It will be shown that such implicit relations can explain phenomena that have hitherto defied adequate explanation such as fracture and the movement of cracks in solids, and such models have the potential to describe the response of fluids with properties that depend both on the invariants of the stress and appropriate kinematical variables. The models also provide a new way to look at turbulence in fluids. Implicit models also provide a framework for describing important problems concerning the flow of non-linear fluids through porous media due to high pressure gradients. Moreover, such implicit constitutive relations lead to governing equations that possess characteristics which are desirable both from the point of view of qualitative mathematical and numerical analysis.