## Elastic materials with a stretching threshold

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Some biological tissues (tendons, ligaments) exhibit a sharp reduction of deformability beyond a stress threshold, below which they may be considered elastic. This behaviour can be extrapolated to a limit situation in which the material becomes undeformable beyond some deformation threshold (to which a stress threshold can be associated). In the fully stretched region the stress can take any value above threshold. As a model problem we have considered the motion of a layer of such a material in which one boundary is kept fixed while to the other a tangential stress is applied which at some time exceeds the threshold value. The corresponding mathematical problem is formulated as a hyperbolic free boundary problem in which the interface marks the transition from the elastic to the fully stretched phase. It is shown that two cases are possible: (i) the stress is continuous at the interface, (ii) the stress has an unknown jump at the interface. Under suitable assumptions on the initial data it is proved that the velocity field has the same behaviour and that in case (i) the interface velocity is lower than the speed of sound in the elastic phase, while in case (ii) the interface may be supersonic. The main physical difference between the two cases consists in the fact that energy is preserved in case (i) and it is dissipated in case (ii). Existence and uniqueness results are proved and some explicit solutions are constructed.

This is a joint work with Angiolo Farina, Lorenzo Fusi, and Kumbakonam R. Rajagopal.