Analysis Seminar

Stress-Rate Type Viscoelastic Models in the Context of Implicit Constitutive Theory

By

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Abstract: In the constitutive equations for the classical viscoelastic models, stress tensor is expressed in terms of the strain tensor and its time derivative. However, the classical elastic and viscoelastic models are incapable of explaining the phenomena when the stress is big and the strain is small which is in fact observed in engineering applications. Rajagopal [1, 2, 3] proposed a new class of models that are able to explain this kind of behaviour for elastic materials and he called them strain-limiting models. We first recall developments on strain-rate type models [6, 4]. To describe such models we assume a nonlinear relationship among the linearized strain, the strain rate and the Cauchy stress. Then, we introduce stress-rate type nonlinear viscoelastic models that obey the assumptions of the strain-limiting theory [5]. The critical hypothesis is that the linearized strain depends nonlinearly on the stress and the stress rate. We show that a one-dimensional stress-rate type model is thermodynamically consistent and compare it with the strain-rate type model mentioned above from the point of view of differential equations of motion. This work is partially supported by TÜUBITAK Grant 120F347.

References

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[4] H. A. Erbay, Y. Sengul, Traveling waves in one-dimensional non-linear models of strain-limiting viscoelasticity, *Int. J. Non-Linear Mech*. 77 (2015), 61-68.
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