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CRACK AND CONTACT PROBLEMS FOR VISCOELASTIC BODIES

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PREFACE

These Lecture Notes contain an account of the material presented at the Advanced School on Crack and Contact Problems for Viscoelastic Bodies held at the International Centre for Mechanical Sciences in Udine (Italy), September 5-9, 1994.

The main emphasis of these Lecture Notes is on constructing solutions to specific problems; however properties of the equations of viscoelasticity that provide the theoretical underpinnings for constructing such solutions are also covered.

Particular attention is paid to the solution of crack and contact problems. This work is of interest in the context of polymer fracture, modelling of material behaviour, rebound testing of polymers and the phenomenon of hysteretic friction.

The most general methods of solution presuppose that inertial effects may be neglected. The evolution of stress singularities at notches and at tips of cracks meeting at the interface between dissimilar viscoelastic media is traced as a function of viscoelastic material properties; with application to special cases, and extension to anisotropy.

For crack problems and contact problems where the contact area varies with time the source of the main difficulty is that the regions over which different types of boundary conditions are prescribed generally vary with time and may not be known apriori. A fundamental decomposition of the hereditary integrals of linear viscoelasticity leads to the solution of a wide variety of non-inertial problems.

Crack propagation in inhomogeneous and viscoelastic media in the presence of inertial effects is also discussed, from different points of view. Both constant speed and accelerating cracks are treated. Also, modelling and thermodynamic restrictions on viscoelastic behaviour are studied. Existence and uniqueness results and wave solutions for linear viscoelasticity are presented. This material complements that described in previous paragraphs.

An aim of the Lecture Notes is to contribute towards bringing linear viscoelasctic stress analysis to the same level of development as linear elastic stress analysis.

It is a pleasure to record here our thanks to the officers of the CISM, and in particular to Professor Giovanni Bianchi, Professor Sandor Kaliszky and Professor Carlo Tasso for inviting us to give the lectures and agreeing to publish them; and for ensuring that our stay in Udine was so very enjoyable and rewarding.

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