

Theory of Crack Front Waves and Related Phenomena

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ABSTRACT

The study of crack front waves, crack stability, the development of roughness etc. requires the solution of the problem of subjecting a crack, propagating smoothly, to a small dynamic perturbation. The problem was first solved, to first order in the perturbation, in the 1990's, for a crack propagating in a plane, through an infinite isotropic elastic medium, but both for in-plane and out-of-plane perturbation. Subsequent developments have provided several generalizations: the body can be viscoelastic and 'vertically stratified', a certain amount of anisotropy can be admitted, and the basic propagation is not limited by basic wave speeds. Developments such as these will be briefly reviewed. A flavour of the analysis will be given, by presenting an outline of the theory for the simple case of in-plane perturbation of a crack propagating under mode-I loading. A novelty is that the perturbation will be carried out to second order which entails introducing a term in the expansion, of a type that is absent at first order. If time permits, the analysis will be related to a recent solution, by entirely different methodology, of the corresponding problem in elastostatics.