Some mathematical questions on fracture dynamics

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In this talk I will present an overview of some mathematical arising in the theory of fracture propagation in elastic solids. In particular, there will be a particular emphasis in the so-called Eshelby-Kostrov property. This is a remarkable property that plays a crucial role in the theory of one-dimensional fracture propagation and was discovered by Eshelby and Kostrov in the sixties. It states that the so-called stress intensity factor depends only on the instantaneous position and speed of the tip of a crack, but that such stress intensity factor is independent on the precise manner in which the crack has developed. Using this result, it is possible to construct a simple theory of one-dimensional crack propagation in brittle solids that can be reduced to ordinary differential equations. I will describe the mathematical structure behind the wave equations that explains why the Eshelby-Kostrov property occurs as well as a counterexample that shows that such a property does not hold in general for curved crack propagation.

(Joint work with A. Friedman)