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CRACK IDENTIFICATION IN ELASTIC STRUCTURES USING TIME REVERSAL

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Time reversal is a well-known procedure in application fields involving wave propagation. Among other uses, it can be applied as a computational tool for solving certain inverse problems. The procedure is based on advancing the solution of the relevant wave problem "backward in time." One important use of numerical time-reversal is that of refocusing, where a reverse run is performed to recover the location of a source applied at an initial time based on measurements at a later time. Usually, only partial, noisy, information is available, at certain measurement locations, on the field values that serve as data for the reverse run. Another important use of time-reversal is for identification of scatterers. Previous work using time-reveral was successful only with point scatterers. The authors have devised a technique which successfully identifies scatterers with a finite size.

In this talk, a procedure based on time-reversal with partial information, on refocusing and on parameter optimization is developed to identify cracks in elastic structures. The location, orientation and size of the crack may be identified by the scheme. Multiple measurement times are employed, which enhance the refocusing and the identification. The effect of measurement noise is studied, and the technique is shown to be quite robust, sometimes even in the presence of very high noise levels. Various features appending the technique are shown to enhance the identification. The computational aspects of the method are discussed, and results are illustrated via numerical experiments.