This communication addresses a computation strategy, based on the adjoint variable approach and BIE/BEM formulations of the direct problem, for evaluating sensitivities of objective functionals with respect to crack or void shape perturbations. Boundary-only expressions for such sensitivities are thus sought, in the context of scalar waves, linear elastostatics or elastodynamics.

In the case of a void, boundary-only expressions for sensitivities of integral functionals defined on (part of) the external boundary are easy to obtain by the standard adjoint variable approach. When the void degenerates to a crack, the previous result ceases to be applicable, however, because non-integrable terms arise due to crack-tip singularities.

We show, for two classes of crack perturbations, that boundary-only sensitivity expressions using an adjoint state can still be obtained:

1. simple transformations (translation, rotation or expansion of the crack) of arbitrarily shaped domains, and
2. general two-dimensional geometries and crack perturbations. In the last case, the shape sensitivity is expressed using the primal and adjoint stress intensity factors.

Numerical tests of the latter kind of sensitivity expression have been performed for elastostatics and elastodynamics problems concerning a 2-D elastic body with an internal crack. The influence of various shape transformation of the crack boundary on an objective displacement functional is examined. The sensitivity results obtained using the present strategy compare well with finite difference evaluations.

A crack identification methodology based on the present sensitivity evaluation strategy is then developed. The internal character of the crack is enforced via geometrical constraints, and a variable metric optimization algorithm with internal penalty function is subsequently applied. A simple crack identification example will be presented.