Application of the reciprocity principle for the determination of planar cracks in piezoelectric material

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The functionality of piezoelectric devices can be strongly reduced by cracks. Due to the brittle material behaviour of piezoelectric ceramics, the question if cracks exist and of their position and size if existing, is of significant interest in engineer applications. We examine the question, how it is possible to test devices for inner cracks (not visible) in a nondestructive manner. We focus to the inverse method of measurements of boundary data under different loads like described by Andrieux et. al. e.g. in [1] and [2]. This approach uses overdetermined information on boundary data to reconstruct inner geometry properties, especially cracks. We utilize a first generalization [3] of the approach in [1] to anisotropic elastic material. Some results of the reconstruction method are demonstrated by numerical experiments in 2D. Sensitivity studies show at the one hand that the reconstruction works well in principle in the case of a single straight crack, but also the limited scope by examining examples with perturbed data, different crack lengths and slightly nonplanar cracks.

References:

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