Detection Of Crack In Plates Using Flexural Vibration Response Data

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Cracks in structural or mechanical components may be detected using measured vibration responses. One approach is to formulate the crack-detection problem in an optimization framework, where the optimal crack parameters are identified based on minimization of the error between simulated and measured responses. In this framework, standard FEM requires repeated re-meshing to get simulated responses. Hence, the extended finite element method (XFEM) can be used to generate the responses since it uses a consistent mesh for different locations, sizes, and orientations of the crack. Herein, efforts are made to detect the crack parameters using out-of-plane flexural vibration responses from a cracked plate. The forward dynamic problem is formulated using XFEM and validated by comparison with standard FEM results. The forward XFEM analysis is then coupled with genetic algorithm to solve the inverse crack-detection problem. The method is illustrated using different types of vibration responses.