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Robust And Fast Identification Of Crack Parameters In A Vibrating Beam Using Modifications In The Unscented Kalman Filter

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Detection of cracks and estimation of their severities are necessary for health monitoring of structural components. Herein, the identification of crack parameters in an Euler Bernoulli beam is investigated by treating it as a nonlinear state estimation problem. An FE model of the cracked beam is constructed by modeling the cracks as massless rotational springs. After undergoing dynamic excitations, the obtained acceleration measurements are used for identification of the structural and crack parameters. For the required joint state-parameter estimation, Unscented Kalman Filter (UKF) is employed. In order to overcome the deficiencies of the traditional UKF, efforts have been made to introduce various types of modifications, which are primarily aimed towards reduction of computational requirements and improvement of robustness against tuning of initial states and covariance matrix. The comparative performance of the proposed variants of UKF is illustrated through a numerical study.