DETECTION OF TRANSVERSE CRACKS IN PRISMATIC CANTILEVER BEAMS AFFECTED BY WEAK CLAMPING USING A MACHINE LEARNING METHOD

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ABSTRACT

Because our infrastructure is aging and approaching the end of its intended functioning time, the detection of damage or loosening of joints is a topic of high importance in structural health monitoring. The most desired way to assess the health of engineering structures during operation is to use non-destructive vibration-based methods that can offer a global evaluation of the structures integrity. A comparison of using different modal data for training feedforward backpropagation neural networks for detecting transverse damages in beam-like structures that can also be affected by imperfect boundary conditions is presented in the current paper. The different RFS, RFS_{min}, and DLC training datasets are generated by applying an analytical method, previously developed by our research team, that uses a known relation, based on the modal curvature, severity estimation of the transverse crack, and the estimated severity for the weak clamping. The obtained dataset values are employed for training three feedforward backpropagation neural networks that will be used for locating transverse cracks in cantilever beams and also detect if the structure is affected by weak clamping. The output from the three ANN models are compared by plotting the calculated error for each case.

Keywords: damage detection, machine learning, natural frequency, structural health monitoring, weak clamping