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Application of Empirical Mode Decomposition to Drive-by Bridge Damage Detection

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Abstract

A new method is proposed in this paper for bridge damage detection using the response measured in a passing vehicle. It is shown theoretically that such a response includes three main components; vehicle frequency, bridge natural frequency and a vehicle speed pseudo-frequency component. The Empirical Mode Decomposition (EMD) method is used to decompose the signal into its main components. A damage detection method is proposed using the Intrinsic Mode Functions (IMFs) corresponding to the vehicle speed component of the response measured on the passing vehicle. Numerical case studies using Finite Element modelling of Vehicle Bridge Interaction are used to show the performance of the proposed method. It is demonstrated that it can successfully localise the damage location in the absence of road profile. A difference in the acceleration signals of healthy and corresponding damaged structures is used to identify the damage location in the presence of a road profile. The performance of the method for changes in the transverse position of the vehicle on the bridge is also studied.

Key words: Bridge; Damage detection; Indirect method

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