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Multiple damage detection in frames using wavelet transforms

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Wavelet transforms are convenient tools in the structural health monitoring and damage detection fields. However, these methods have encountered some limitations in practical usage. Thus, signal energy analysis was also used as an alternative technique for damage detection. In this research, firstly, comparison between the wavelet and signal energy methods for frame type structures with different support conditions and multiple damage scenarios has been conducted. Then, Discrete Wavelet Transforms (DWT) and Teager Energy Operator (TEO) have been applied on the curvature of mode shapes of the beams, and the locations of the damages have been identified. The results show that in compare with discrete wavelet transform signal energy operator has preference. This superiority in detecting the damages, especially near the supports of the beam, is obvious, and contains enough sensitivities in low damage intensities. Additionally, the damage detection in the cases that the response data is noisy has been investigated. For this purpose, by adding low intensity noises to the curvature of the mode shapes, the abilities of mentioned methods have been evaluated. The results indicate that each method is not individually efficient in recognizing damages in noisy condition, but the combination of them under noisy conditions is more reliable.

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