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Damage Identification in Steel Beam Structures Based on the Comparison of Analytical Results of Wavelet Analysis

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Numerous researchers focus on monitoring the health of structures to ensure safety and reduce maintenance costs. Beams and columns are the primary elements of structures in civil engineering, and designers expect beams and columns to be the last elements to experience damage. This paper identifies steel beam damage based on dynamic modal data. After a modal analysis was performed on the modeled beam using the ABAQUS finite element software, modal information was extracted, including the frequencies and shapes of healthy and damaged modes. Due to the presence of damage, differences in the frequency values of primary and secondary conditions were observed. In addition, modal assurance criteria (MAC) values below one were obtained, confirming the presence of damage. Using an analytical method based on wavelet analysis, MATLAB.R2021a processed healthy and damaged mode shape signals. In all modes, a comparison of the output signal diagrams of healthy and damaged modes revealed the difference in the damaged area, allowing the damage locations to be identified with an error of less than 2 percent using a simple examination.

Keywords: Structural Health Monitoring, Modal Analysis, Signal Processing, Wavelet Transform, Damage Identification.

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