I-beam Crack Identification Based on Study of Local Flexibility due to Crack

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Received April 7, 2010; revised April 19, 2011; accepted April 29, 2011; published electronically May 12, 2011

Abstract: Local flexibility of crack plays an important role in crack identification of structures. Analytical methods on local flexibility in a cracked beam with simple geometric crossing sections, such as rectangle, circle, have been made, but there are some difficulties in calculating local flexibility in a cracked beam with complex crossing section, such as pipe and I-beam. In this paper, an analytical method to calculate the local flexibility and rotational spring stiffness due to crack in I-beam is proposed. The local flexibility with respect to various crack depths can be calculated by dividing a cracked I-beam into a series of thin rectangles. The forward and inverse problems in crack detection of I-beam are studied. The forward problem comprises the construction of crack model exclusively for crack section and the construction of a numerically I-beam model to gain crack detection database. The inverse problem consists of the measurement of modal parameters and the detection of crack parameters. Two experiments including measurement of rotational spring stiffness and prediction of cracks in I-beam are conducted. Experimental results based on the current methods indicate that relative error of crack location is less than 3%, while the error of crack depth identification is less than 6%. Crack identification of I-beam is expected to contribute to the development of automated crack detection techniques for railway lines and building skeletons.

Key words: crack, identification, I-beam, local flexibility

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This project is supported by National Natural Science Foundation of China (Grant No. 50805114), National Basic Research Program of China (No. 2011CB706805)