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Vibration Test of Circular Concrete-Filled Steel Tubular (CFST) Beams

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Abstract

This paper studies the vibration properties of circular concrete-filled steel tubular (CFST) beams and their potential applications in determining the flexural stiffness of CFST and detecting steel-concrete interface debonding. A total of 8 specimens, 4 intact ones and 4 with circumferential debonding, were tested with impact hammer excitation. The frequency response function (FRF) curves of the specimens were calculated and the first few modes of natural frequencies and mode shapes of the specimens were extracted. Numerical model was established to predict the natural frequencies of the intact CFST beams. By comparing the predicted and extracted natural frequencies, the flexural stiffness of the beam was calibrated. It shows that employing the gross flexural stiffness in the numerical model could predict the natural frequencies of CFST with good accuracy. The major characteristics of debonded CFST vibration was also summarized, including the presence of extra modes and the reduction of natural frequencies of flexural modes. Such characteristics could be used as indicators of steel-concrete interface debonding in CFST structures.

Keywords: Concrete-filled steel tube (CFST), Modal test, Modal parameters, Flexural stiffness, Debonding.