

Active And Semi-Active Control Of In-Plane Parametric Vibration Of Super-Long Stay Cable Subjected To Axial Excitation

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Nonlinear parametric vibration of stay cables in cable-stayed bridge are common in many vibrations of super-long stay cables. The vibration control of a super-long stay cable is an important task for maintaining such stay cables and improving the cable-stayed bridges reliability. Although using quadratic parabola as the cable gravity sag curve is the most common method when establishing the parametric vibration differential equations of cables, great error would be caused when it used in terms of super-long cable. Thus, in this paper, a gravity sag curve equation including the chord wise force of gravity is applied to establish the governing equation of the stay cable subjected to axial excitation to reduce errors. Then, this paper proposes an intelligent semi-active control strategy to reduce the large parametric resonance amplitude of stay cables. To this end, based on the targeted LQR optimal active control law, an active control system of the stay cable is established. To analyze the parametric influences on the performance of the LQR-based optimal active control system, as the study object, the longest cable S36 in Hutong Yangtze River Railway Bridge is applied to the control system, and numerical analysis results are obtained. In order to apply the control strategy to engineering practice, with the premise that the semi-active control could emulate the targeted active optimal control, a semi-active control strategy employed MRFD is proposed to mitigate the parametric vibration of super-long stay cable. On the basis of the designed active control system, a semi-active control system attached with MRFD is designed. Numerical analysis results confirm that the designed semi-active system could provide the similar performance compared to the active control system.