

Experimental investigations on cable vibration mitigation using a VIMD

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ABSTRACT

Recently, the superiority, concerning vibration mitigation, of passive devices possessing properties of negative stiffness, such as VIMD, has been widely studied by many researchers. It was found that a VIMD may achieve modal damping ratios of a cable up to 10 times the values reached by a traditional viscous damper (VD). However, the control performance using a VIMD from the existing experimental studies was not as high as the value predicted by the theory, and still requires validation. In this study, experimental investigations were carried out on a scaled sagged cable (19.47 m long) with a VIMD for validations of cable vibration mitigation using a VIMD, where the VIMD was installed at 2.1% of the cable length near the bottom end. A VIMD prototype with adjustable damper parameters (damping and inertial mass) was designed and manufactured. There are good agreements between the experimental results and theoretical results. Moreover, it shows that the control performances using a VIMD are better than those using a traditional VD. The first modal damping ratio is remarkably enhanced with the installing of the VIMD. The identified maximum modal damping ratio of the first mode is 6.98%, which is almost 10 times the maximum value of those using a VD, 0.69%.

KEYWORDS: viscous inertial mass damper; sagged cable; vibration control; scaled experiment;

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