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Experimental Verification of a Universal Formula on Damping Enhancement for Long Stay Cables with External Dampers

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ABSTRACT
Vibration mitigation of stay cables using external dampers, such as viscous dampers, elastic-viscous dampers, and magneto-rheologcial (MR) dampers has been widely adopted in engineering practice. In order to facilitate damper design and damper-effectiveness evaluation, a universal formula on damping enhancement for long stay cables with external dampers has been formulated by the authors to account for the effect of damper coefficient, damper stiffness, damper mass, damper friction force, stiffness of damper support, and sag and inclination of stay cables. This paper presents the experimental verification of this universal formula. A model cable scaled from the world-longest cable of Sutong Bridge, China, has been firstly established. A novel damping device with mechanically variable damper parameters are designed and fabricated. Then the effect of individual damper parameters on damper enhancement of the cable damping enhancement is experimentally studied using the model cable and damping device. Studies indicate that the damper stiffness and the softening of support stiffness reduce the achievable damping ratio, and proper increase of damper mass will raise the achievable damping ratio. Experimental results quantitatively agree well with the theoretical prediction of the universal formula. Therefore, the universal formula is experimental verified and can be used by engineers for external damper design for long stay cables.

KEYWORDS: *stay cable; external damper; vibration mitigation; damping enhancement; experimental verification*