

عنوان مقاله:

Galloping and VIV control of square-section cylinder utilizing direct opposing smart control force

محل انتشار:

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خلاصه مقاله:

An adaptive fuzzy sliding mode controller (AFSMC) is adopted to reduce the 2D flow-induced vibration of an elastically supported square-section cylinder, free to oscillate in stream-wise and transverse directions in both lock-in and galloping regions. The AFSMC strategy consists of a fuzzy logic inference system intended to follow a sliding-mode controller (SMC), and a robust control system designed to retrieve the variance between the sliding mode and fuzzy controllers. The sprung square cylinder first experiences vortex-induced vibrations with increasing Reynolds number, and then, after passing the critical flow velocity, it confronts high-amplitude and low-frequency vibrations of galloping owing to its sharp corners. A co-simulation platform is considered by linking the AFSMC system modeled in Matlab/Simulink to the plant model implemented in Fluent, aiming at the calculation of opposite control force needed for comprehensive annihilation of the cylinder motions. Based on the performed numerical simulations, it becomes clear that the utilized active control system has successfully mitigated the two-degree-of-freedom vibrations of a square cylinder in both the lock-in region and galloping zone. Here, the vibration amplitudes in the transverse and streamwise directions have decreased by 93% and 94%, for the lock-in region and 93% and 99%, for the galloping zone, respectively.

کلمات کلیدی:

Galloping, Flow-induced vibration, Square-section cylinder, Intelligent controller, active controller

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