

Shock Isolation Performance of a Pre-Compressed Large Deformation Shock Isolator with Quasi-Zero-Stiffness Characteristic

Authors : Ji Chen, Chunhui Zhang, Fanming Zeng, Lei Zhang, Ying Li, Wei Zhang

Abstract : Based on the synthetic principle of force, a pre-compressed nonlinear isolator with quasi-zero-stiffness (QZS) is developed for shock isolation of ship equipment. The proposed isolator consists of a vertical spring with positive stiffness and several lateral springs with negative stiffness. An analytical expression of vertical stiffness of the nonlinear isolator is derived and numerical simulation on the effect of the geometric design parameters is carried out. Besides, a pre-compressed QZS shock isolation system model is established. The stiffness characteristic of the system is studied and the effects of excitation amplitude and friction damping on shock isolation performance are discussed respectively. The research results show that in comparison with linear shock isolation system, the pre-compressed QZS shock isolation system could realize constant-force or approximately constant-force function and perform better anti-impact performance.

Keywords : quasi-zero-stiffness, constant-force, pre-compressed, large deformation, shock isolation, friction damping

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