

## **New Modification Negative Stiffness Device with Constant Force-Displacement Characteristic for Seismic Protection of Structures**

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**Abstract :** As a seismic protection method of civil and engineering structures, weakening and damping is effective during the elastic region, while it somehow leads to the early yielding of the entire structure accompanying with large excursions and permanent deformations. Adaptive negative stiffness device is attractive for realizing yielding property without changing the stiffness of the primary structure. In this paper, a new modification negative stiffness device (MNSD) with constant force-displacement characteristic is proposed by combining a magnetic negative stiffness spring, a piecewise linear positive spring and a passive damper with a certain adaptive stiffness device. The proposed passive control MNSD preserves no effect under small excitation. When the displacement amplitude increases beyond the pre-defined yielding point, the force-displacement characteristics of the system with MNSD will keep constant. The seismic protection effect of the MNSD is evaluated by employing it to a single-degree-of-freedom system under sinusoidal excitation, and real earthquake waves. By comparative analysis, the system with MNSD performs better on reducing acceleration and displacement response under different displacement amplitudes than the scenario without it and the scenario with unmodified certain adaptive stiffness device.

**Keywords :** negative stiffness, adaptive stiffness, weakening and yielding, constant force-displacement characteristic

**Conference Title :** ICDVCA 2020 : International Conference on Dynamics, Vibration and Control Applications

**Conference Location :** Paris, France

**Conference Dates :** December 28-29, 2020