

A New Neutral Equilibrium Mechanism Applied to Force Control and its Application

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ABSTRACT

Force control is an important task in many application fields of engineering, such as semi-active damper for energy dissipation and semi-active isolation for protecting structures under ground motion excitations. Common devices for aforementioned control techniques consist of a sliding member, a reaction member, an actuator and a controller. Two design logics are usually considered: rigid reaction members or elastic reaction members. While stiff counter-parts result in minimization of energy requirement of the actuator, the soft counter-parts lead to smoothly precise regulation of friction force. In this study, a neutral equilibrium mechanism was proposed for providing a smoothly precise regulation of friction force with a minimal power supply. The proposed mechanism consists of fundamental mechanical components such as springs, sliding guides, mini electric motor controlled actuator. The mechanism was conducted and tested. We conducted component testing of the aforementioned mechanism and conducted structural experiments on a scaled-down 2-story building structure to verify the applicability of the mechanism. The experimental results reveal that this mechanism can achieve power magnification up to 500:1 and a very good control behaviour of the building structure.