

Mitigation of the structure response based on inertial shock-absorber

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ABSTRACT

The goal of this paper is to present further development of the inertial shock-absorber called SPIN-MAN. Application of the device in mitigation of structures response is investigated and selected case study is discussed. The specific construction and operation of the device is introduced and explained. In reference to the impact absorption problems, the SPIN-MAN is a concept of adaptive inerter device with two phases of operation. The first of them includes energy absorption and accumulation. External energy of the load is converted to kinetic energy of rotational motion of the mass. During the second phase, accumulated energy is dissipated by inverse spinning of the second mass powered by the remaining part of the impact energy. To obtain this type of operation, special switchable actuators are used.

Applicability of the device in mitigation of impact-born structure response, especially in case of space systems, is investigated. General concept of the device construction and operation is adjusted to meet the requirements for space systems. This results in a fluidless, passive-like solution but adaptable to the load conditions. Tuning of the shock-absorber may be realized by manual or easily automated mechanical adjustments. Effectiveness of the solution is based on the specific on/off type of control, which is responsible for the optimal energy flow in the system and efficient dissipation of impact energy inside the SPIN-MAN. Results of numerical simulations confirmed quick and effective operation of this device.

Keywords: *structure response mitigation, adaptive impact absorption, adaptive inerter, semi-active control, shock-absorber.*