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FONDAZIONE

the control algorithm, the TRD is numerically and experimentally applied on a single degree of freedom oscillator. By that, the efficiency of the algorithm is studied for the cases of free vibrations and stochastically forced vibrations.

MS12.III - Tuesday 12 September, 09:40-11:10

A decentralized strategy of structural reconfiguration in mitigation of vibrations

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In recent years, on/off-type control strategies, based on semi-actively controlled accumulation and release of strain energy, have attracted a relatively high interest and have been proven to be highly effective in mitigation of structural vibrations. However, almost all published researches are systemically restricted in that they study effectively the same basic example (the fundamental vibration mode of a cantilever-type beam composed of two detachable layers) with the same general control strategy (global energy transfer from the fundamental vibration mode to the high-frequency highly-damped longitudinal mode), and differ only in the implementation details of the applied control technique (truss-frame nodes with controllable moment-bearing ability, controllable delamination, magnetorheological elastomers, jammed granular material, etc.). This contribution approaches the problem using controllable truss-frame nodes (blockable hinges). Such nodes are capable of a controlled transition between the truss and the frame mode (zero to full moment-bearing ability), which is equivalent to local structural reconfiguration. As the main novelty factor, we propose a new closed-loop decentralized control strategy, which is based on a local energy measure and does not need any global structural model. The proposed control algorithm is readily applicable to structures of various types and subjected to various vibration patterns. We will formally define the problem, propose the decentralized control algorithm, and test it in several numerical examples to demonstrate its high effectiveness. We will include also selected experimental results obtained in a laboratory stand involving piezo-driven truss-frame nodes.

Nonlinear passive damping of the x-shaped structure

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Natural biological systems can always demonstrate amazing properties or performance subject to external excitation. The nonlinear damping characteristics of a passive bio-inspired limb-like structure (LLS) or X-shape structure is studied in this paper with theoretical modelling and extensive experimental validation. It is revealed that, (1) the linear horizontally-placed damper can produce equivalent nonlinear damping in the vertical direction; (2) the equivalent damping characteristic is a nonlinear function of the vibration displacement and varying at different frequency; (3) the structural rod length, rod length ratio, layer number, and assembly angle can all affect the equivalent nonlinear damping and thus can be used to tune the damping characteristic in practice; (4) the equivalent damping is shown to be adjustable and can be very high at around resonance frequency but very low at other frequencies, showing an ideal nonlinear damping property. The results of this study demonstrate the feasibility of an innovative and passive solution for designing desired damping characteristics in various engineering practices by employing the LLS.

Including inerters in aircraft landing gear shock strut to improve the touch-down performance

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The inerter is a novel mechanical element with the property that the applied force is proportional to the relative acceleration between its terminals. Recently, the beneficial use of inerters in a wide range of mechanical structures have been identified, such as in road vehicles, railway vehicles and tall buildings. In this paper, the potential advantages of incorporating inerters in an aircraft landing gear shock strut are investigated. It is commonly accepted that the greatest energy requirement for the landing gear shock absorber is determined by the landing touch-down case. This defines the performance of a shock absorber. A simplified