Mitigation of dynamic response in frame structures
by means of smart joints

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ABSTRACT

This paper discusses passive and semi-active techniques of structural control by means of smart joints, see, e.g., [1–4], and then proposes and tests an influence of specific smart joints included in a frame structure regarding capabilities of mitigation of vibrations. Basically, the proposed solution modifies frame beams by addition of truss-type hinges, and its effectiveness relies on the softening effect that occurs in compression due to geometric nonlinearities and which triggers highly-damped high-frequency response of the structure.

First, the finite element (FE) model of the specific frame structure with geometrical nonlinearities is derived, and the proposed passive joints are described and incorporated into the model. Then, their principle of operation and effectiveness is examined numerically for a number of first natural modes of vibrations with various excitation amplitudes. An objective function is proposed to assess truss specific joint placements, based on the efficiency in mitigation of the excited vibrations. Finally, a semi-active control scheme is proposed and tested in the exemplary numerical case study.

REFERENCES