An experimental investigation of the Prestress Accumulation Release strategy for local mitigation of structural vibrations

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ABSTRACT

Prestress Accumulation Release (PAR) is a recently developed control strategy for mitigation of structural vibrations [1,2]. It utilizes an extremely effective approach, based on the general concept of controllable structural constraints, which assumes that it is possible to introduce short lasting modifications of the local effective stiffness of vibrating structures. In practice, the method requires dedicated semi-actively controllable fuses to be implemented in the structure, which allow local mechanical properties to be modified in a controllable way [3].

The investigations published until now revealed, both numerically and experimentally, a superior effectiveness of the PAR-based vibration control approach, which stems from an optimization procedure and a basic mechanical analysis of the control problem [2]. The experimental verification of the previous results were focused on testing of the control law and implementing the control algorithm [4], and they prepared the ground for development of a methodology for the optimal distribution of the semi-active fuses within the structure.

This contribution presents an experimental analysis of the control system configuration for a semi-active frame structure. The structure is equipped with a system that implements the PAR strategy for mitigation of vibration. A proper distribution of the sensors for monitoring the actual state of the structure is the key factor that determines the overall effectiveness of the applied strategy. The results and findings presented here reveal a set of basic rules dedicated to solving this crucial issue.

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