

Semi-Active Interface (SAI) Technique for Suppressing of Impact Born Vibrations

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In the class of ultra-light structures (e.g. space structures) there is a strong need for innovative techniques allowing suppression of impact born vibrations (due to lack of sufficient material damping). Therefore, the objective of our SAI concept is to propose an effective technique, allowing suppression of impact born vibrations with zero mass added to the ultra-light structure and based on the following steps:

- design a multi-layer structure capable of a semi-active “delamination” control along the contact interfaces (slipping lines),
- apply an actuator realizing the on/off type of semi-active control for slipping lines’ activation, playing the role of structural clutch (c.f. the actuator in the so-called PAR vibration suppression technique, [1-4]),
- apply various characteristics for the contact interfaces (friction coefficients),
- apply various control strategies for suppression of vibrations, dependent on the case study and dynamic excitation.

A case study of a dynamically excited two-layer beam shows a significant effect on vibration suppression caused by their intentional delamination and the associated internal friction. In case of random, impact born vibrations, proper initial prestressing can increase the final damping effect, which is due to stored additional slipping distortions available. In case of several potential slipping lines and various ways of dynamic excitations, more sophisticated algorithms for optimal solutions, like AI, can be applied for effective suppression of vibrations.

References

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