Institut des Sciences de la Mécanique et Applications Industrielles

Post-doctoral position:
Passive control of vibrations with a magnetic vibration absorber

The passive control of vibration is a key problem in numerous engineering applications, ranging from aeronautics to civil engineering. In the past, numerous methods have been developped, from the well-known Tuned-Mass Damper (TMD or TVA: Tuned Vibration Absorber) originally proposed by Frahm, the optimal parameters of which have been given by Den Hartog, and Asami in Nishihara [1,2]. In the last decade, new trends for passive mitigation of vibrations have been studied, with a major focus in extending the operational range of the TVA in the frequency domain as well as to nonlinear systems. The Nonlinear Energy Sink (NES), possessing an essential nonlinearity as a restoring force, has been shown to be key for extending the frequency range of the TVA by ensuring a broadband, targeted energy transfer [3]. The NLTVA (Nonlinear Tuned Vibration Absorber) has the purpose to control not only the linear vibrations of a primary structure but also its nonlinear characteristics for a broader range of applicability in terms of vibration amplitudes [4]. Finally, recent studies exploit the possibility of introducing a negative linear stiffness in order to enhance the applicability conditions of the NES [5].

The post-doctoral position offered at ENSTA-ParisTech aims at investigating the use of a magnetic vibration absorber, that has the unique capacity of being easily and passively tuned by adjusting geometric parameters. A first study has been realized on the conception of the device, showing that a large range of linear as well as nonlinear (cubic and quintic) characteristics are amenable within the same device [6]. The absorber has been fully characterized statically and dynamically in different configurations, and a model behaviour has been derived using multipolar expansions for the magnetic field coupled to mechanical adjustements. The absorber can thus be used on a primary structure as a TVA, a NES, a NLTVA or a bi-stable absorber. This would allow one to draw extensive comparisons of the performance of such absorbers on the same primary structure, in order to clearly assess their main advantages and drawbacks. The post-doctoral fellow will have the responsibility of designing a complete set-up including a primary structure, adjust the mounting of the magnetic absorber on the structure and finely tune its characteristics in order to explore the different possibilities and record their relative performances, in terms of frequency range applicability, capacity in controlling the nonlinear vibrations, optimal adjustement of characteristics and damping, etc... An extension to the control of the flutter instability could also be an objective for the end of the study.

The applicant should show good skills in experimental techniques for vibration measurements, as well as basic theoretical knowledge in vibration identification and nonlinear dynamics. The post-doctoral position is open for one year starting at best from october 2015.

Contact

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References

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