

Jiang, Xiaoi; McFarland, D. Michael; Bergman, Lawrence A.; Vakakis, Alexander F.
Steady state passive nonlinear energy pumping in coupled oscillators: Theoretical and experimental results. (English) [Zbl 1039.70506](#)
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Summary: We study theoretically and experimentally the effect that a nonlinear energy sink (NES) has on the steady state dynamics of a weakly coupled system. The NES possesses essentially nonlinear (nonlinearizable) stiffness nonlinearity of the third degree. We find that, in contrast to the classical linear vibration absorber, the NES is capable of absorbing steady state vibration energy from the linear oscillator over a relatively broad frequency range. This results in localization of the steady state vibration in the NES, away from the directly forced subsystem. For a forward frequency sweep the localized branch of steady state motions is suddenly eliminated by a jump to a linearized low-amplitude motion, whereas, for a backward frequency sweep a reverse jump occurs. The difference in the frequencies of the two jumps introduces a nonlinear hysteresis loop. This work extends to the steady state case of earlier transient passive energy pumping results. The notion of passively transferring vibration energy to an a priori determined NES, weakly attached to a main structure, is novel. The use of nonlinear energy sinks for passively absorbing energy from a linear main structure can form the basis of relatively simple and modular vibration and shock isolation designs of mechanical systems.

MSC:

[70K99](#) Nonlinear dynamics in mechanics

[70-05](#) Experimental work for problems pertaining to mechanics of particles and systems

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Keywords:

[nonlinear energy sink](#); [nonlinear hysteresis](#)

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