

Understanding and Constructive Utilization of Nonlinear Phenomena in Structural Dynamics

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Nonlinear systems are known to exhibit complex dynamical phenomena. One of the key features of nonlinear oscillations is the dependence of their frequencies on energy. This presentation introduces an efficient algorithm, geared toward high-dimensional systems, for computing and understanding this frequency-energy dependence. The algorithm is illustrated using several examples, including a full-scale aircraft. The presentation also shows that the intentional use of nonlinearity may offer great opportunities for engineering design. Specifically, we examine how the frequency-energy dependence of nonlinear oscillations can be a means to achieve novel functionalities for passive vibration mitigation. Two nonlinear vibration absorbers, namely the nonlinear energy sink and the nonlinear tuned vibration absorber, are presented, and their respective performances are discussed.