**Brief Introduction to Nonlinear Vibration and Passive Control of Nonlinear Characteristics of Structures with Topology Optimization**

Abstracts

Nonlinear behavior is ubiquitous in nature and ranges from structural dynamics, via fluid dynamics, neural and cell dynamics to the dynamics of financial markets. The most prominent feature of nonlinear systems is that small external disturbances can induce large changes in their behavior. This can and has been used for effective feedback control in many systems, from Lasers to chemical reactions and the control of nerve cells and heartbeats. Clearly, though, linearity is an idealization, nonlinearity is a frequent occurrence in real-life applications. Apply traditional linear analysis to nonlinear systems results, at best, in a suboptimal design. Thus, there is a need for efficient, analytically rigorous, broadly applicable analysis techniques for nonlinear structural dynamics. In this context, nonlinear normal modes (NNMs) offer a solid theoretical and mathematical tool for interpreting a wide class of nonlinear dynamical phenomena, yet they have a clear and simple conceptual relation to the linear normal modes (LNMs), with which practicing structural engineers are familiar. This study will deliver two main subjects regarding nonlinear dynamic behaviors. One is about brief concepts of NNMs and its real applications. The other is about passive control of static and dynamics characteristics of nonlinear structures with topology optimization method. Thin plate is used as an object structure to be dealt with in the presentation, because large deformation of the thin plate has been widely used in various engineering applications.