

Toward optimal design of nonlinear mechanical systems using bifurcation analysis

As many industries face rapidly increasing demands from technological, economic and environmental pressures, nonlinear behaviors are more and more frequently encountered in engineering structures. In this context, there is a need to develop design methodologies that can embrace nonlinearity for its positive effects but that can, at the same time, mitigate the unwanted dynamical phenomena that may arise in nonlinear systems. In this presentation, we describe how the different attractors of a nonlinear system including quasiperiodic regimes of motion and detached resonance branches can be revealed through bifurcation detection and how they can be subsequently eliminated through bifurcation tracking. To this end, we introduce a harmonic-balance-based methodology geared toward the bifurcation analysis of large-scale systems. The method is demonstrated using a real satellite possessing a nonlinear vibration isolation device.