Global Attractor and Rotation Number of a Class of Nonlinear Noisy Oscillators

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Abstract

The current paper is concerned with the global dynamics of a class of nonlinear oscillators driven by real or white noises, of which a typical example is a shunted Josephson junction exposed to some random medium. Applying random dynamical systems theory, it is shown that a driven oscillator in the class under consideration with a tempered real noise has a one-dimensional global random attractor provided that the damping is not too small. Moreover, restricted to the global attractor, the oscillator induces a random dynamical system on S^1. It is then shown that there is a rotation number associated to the oscillator which characterizes the speed at which the solutions of the oscillator move around the global attractor. The results extend the existing ones for time periodic and quasi-periodic Josephson junctions and can be applied to Josephson junctions driven by white noises.

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