The dynamical behavior of a piecewise oscillator

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Talk Abstract

Oscillations have been always present either in engineering devices or in physical systems. It is therefore important to understand its nature and sometimes to control them. Since differential equations are the mathematical model most commonly used for both engineering systems and natural phenomena, it is easily understandable why the study of the complexity of its solutions has been a subject of research for the last decades (see, for example, [1] and [5]). In this talk we consider a forced damped piecewise linear oscillator whose motion is modeled by a second-order non-autonomous differential equation. The system has a continuous regime, where the time flow is characterized by the explicit solutions of the ordinary differential equations, and a singular regime, where the time flow is characterized by an appropriate transformation linking the explicit solutions from one domain to the other. So, our system is globally nonlinear and presents complex behavior which is studied using numerical simulations, with similar techniques as the ones applied in [4]. From our previous works, [2] and [3], we know that, for large subsets of the parameter space the oscillator motion can switch rather wildly from a regular to a complex dynamics with a subtle change of parameters. Now we determine regions of the parameter space where the Poincaré map, which describes the observed motion of the forced damped oscillator, can be classified as m-modal map, for given m natural.

Keywords: dynamical systems, piecewise linear oscillator, interval map, chaos.

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