

Analytical periodic motions to chaos in nonlinear dynamical systems

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Abstract: Analytical solutions of period- m flows and chaos in nonlinear dynamical systems are presented through the generalized harmonic balance method. The mechanism for a period- m flows jumping to another period- n motion in numerical computation is found. The period-doubling bifurcation via Poincare mappings of dynamical systems is one of Hopf bifurcations of periodic flows. The stable and unstable period- m motions can be obtained analytically. In addition, the stable and unstable chaos can be achieved analytically. The methodology presented in this paper is independent of small parameters. The nonlinear damping, periodically forced, Duffing oscillator was investigated as an example to demonstrate the analytical solutions of periodic motions and chaos.

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