Annals of the Academy of Romanian Scientists
Series on Mathematics and its Applications
ISSN 2066 - 6594 Volume 3, Number 1 / 2011

In Memoriam Adelina Georgescu

ATTRACTORS OF THE PERIODICALLY FORCED RAYLEIGH SYSTEM*

Petre Băzăvan†

Abstract

The autonomous second order nonlinear ordinary differential equation (ODE) introduced in 1883 by Lord Rayleigh, is the equation which appears to be the closest to the ODE of the harmonic oscillator with dumping.

In this paper we present a numerical study of the periodic and chaotic attractors in the dynamical system associated with the generalized Rayleigh equation. Transition between periodic and quasiperiodic motion is also studied. Numerical results describe the system dynamics changes (in particular bifurcations), when the forcing frequency is varied and thus, periodic, quasiperiodic or chaotic behaviour regions are predicted.

MSC: 34K28, 37C50, 37C70, 37G15, 37M20.

keywords: Periodic and chaotic attractors, bifurcations, Poincaré map and sections, Lyapunov exponents, periodic and quasiperiodic motion.

1 Introduction

The nonautonomous second order nonlinear ODE with time dependent sinusoidal forcing term, given by Diener [1979, 1],

$$\varepsilon\,\ddot{x} + \frac{\dot{x}^3}{3} - \dot{x} + ax = g\sin\omega t, \tag{1}$$

*Accepted for publication on December 16, 2010.

†bazavan@yahoo.com Department of Informatics, University of Craiova