# GEOMETRIC METHOD FOR FREE OSCILLATOR UNDER TWO PARAMETRIC PERTURBATION

**Z. AFSHARNEZHAD**
DEPT.OF APPLIED MATH. FERDOWSI UNIVERSITY OF MASHHAD, MASHHAD-IRAN
E-MAILS:AFSHARNEZHAD@MATH.UM.AC.IR

ABSTRACT. The free oscillation is the harmonic at which any body tends to vibrate most freely . By geometric method of the theory of bifurcation , refined and developed of the Melnikov function; we prove the existence of the periodic orbit for the free oscillator under two parametric perturbation. In fact we use the geometric method of multi-parameter bifurcation theory in order to prove the persistence of the periodic orbit. By this method we consider the effect of forcing and nonlinear damping on the free oscillator simultaneously. Also we consider the effect of detuning on the system. At the end we apply the method on the forced Rayleigh equation.

**AMS Classification:34C**

**Keywords:** Perturbation and Bifurcation theory - Damping and Detuning- Free oscillator.

## 1. INTRODUCTION

The search for harmonic and subharmonic periodic solutions to nonlinear and linear oscillators such as Van der Pol ,Duffing and free oscillator system,..., has a long and distinguished pedigree. Oscillations play a prominent role in physical, engineering and biological problems. The free oscillator is a system which has periodic orbit and there is no time-dependent force applied to the oscillator. For example: 1). Oscillating on the spring; 2). After a large earthquake the Earth measured in minutes. These are called free oscillations because they continue without any

[1]This research was supported by Ferdowsi university of Mashhad



1644