International Journal of Applied Mathematics
& Statistical Sciences (IJAMSS)
ISSN(P):2319-3972; ISSN(E): 2319-3980
Vol. 5, Issue 2, Dec – Jan 2016; 29-40

International Academy of Science, Engineering and Technology
Connecting Researchers; Nurturing Innovations

HOMOCLINIC BIFURCATION IN A SECOND ORDER DIFFERENTIAL EQUATION

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ABSTRACT

In this paper we have focused on homoclinic bifurcation in a second order nonlinear differential equation.

Bifurcation theory attempts to provide a systematic classification of the sudden changes in the qualitative behaviour of dynamical systems. A bifurcation occurs when a small smooth change made to the parameter values (the bifurcation parameters) of a system causes a sudden qualitative change in its behaviour. Bifurcations are broadly classified into two types- local and global. Local bifurcation is associated with equilibria or cycles. Homoclinic bifurcation belongs to the global bifurcation category which deals with bifurcation events that involve larger scale behaviour in state space. A bifurcation which is characterized by the presence of trajectory connecting equilibrium with itself is called homoclinic bifurcation. Roughly speaking, a homoclinic orbit is an orbit of a mapping or differential equation which is both forward and backward asymptotic to a periodic orbit which satisfies a certain non-degeneracy condition called ‘‘hyperbolicity”.

The Melnikov method which uses Melnikov distance function provides a measure of the distance between a stable and unstable manifold. This method is used in our investigation.

KEYWORDS: Global Bifurcation, Stable and Unstable Manifold, Heteroclinic and Homoclinic Points and Orbits, Melnikov Method