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Multiplicity of Periodic Solutions for a Class of Second Order Hamiltonian Systems

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Abstract: In this paper, we study the multiplicity of periodic solutions for two classes of sublinear nonlinearity second order Hamiltonian systems by the use of minimax methods, in critical point theory. Our results improve and generalize those in some known literatures.

Keywords: *Hamiltonian system; periodic solutions; sublinear nonlinearity; saddle point theorem.*

Mathematics Subject Classification (2010): 34C37.

1 Introduction

Consider the following Hamiltonian system with unbounded nonlinearities

$$\begin{cases} \ddot{u}(t) + Au(t) - \nabla F(t, u(t)) = e(t), \ \ a.e.\ t \in [0, T], \\ u(0) - u(T) = \dot{u}(0) - \dot{u}(T) = 0, \end{cases} \tag{HS}$$

where A is a $(N \times N)$-symmetric matrix, $e \in L^1(0, T; \mathbb{R}^N)$, $T > 0$, and $F : \mathbb{R} \times \mathbb{R}^N \longrightarrow \mathbb{R}$ is a continuous function, T-periodic in the first variable and differentiable with respect to the second variable with continuous derivative $\nabla F(t, x) = \frac{\partial F}{\partial x}(t, x)$.

The study of the existence and multiplicity of periodic solutions of Hamiltonian systems plays a very important role to solve many problems of natural sciences such as chemistry, biology and physics. For physics problem, we can cite planetry systems and fluid dynamic problem.

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