

Accepted Manuscript

Rotating periodic solutions for super-linear second order Hamiltonian systems

Guanggang Liu, Yong Li, Xue Yang

PII: S0893-9659(17)30361-0
DOI: <https://doi.org/10.1016/j.aml.2017.11.024>
Reference: AML 5386

To appear in: *Applied Mathematics Letters*

Received date: 9 September 2017
Revised date: 29 November 2017
Accepted date: 29 November 2017

Please cite this article as: G. Liu, Y. Li, X. Yang, Rotating periodic solutions for super-linear second order Hamiltonian systems, Appl. Math. Lett. (2017), <https://doi.org/10.1016/j.aml.2017.11.024>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



ROTATING PERIODIC SOLUTIONS FOR SUPER-LINEAR SECOND ORDER HAMILTONIAN SYSTEMS

GUANGGANG LIU, YONG LI*, XUE YANG

ABSTRACT. In this paper we consider a class of super-linear second order Hamiltonian systems. We use Morse theory to obtain the existence and multiplicity of rotating periodic solutions, which might be periodic, subharmonic or quasi-periodic ones.

1. INTRODUCTION

Consider the following second order Hamiltonian system

$$-x'' = V_x(t, x), \quad (1.1)$$

where $V_x(t, x) \in C^1(\mathbb{R} \times \mathbb{R}^n, \mathbb{R})$ with $V(t+T, x) = V(t, Q^{-1}x)$ for some orthogonal matrix $Q \in O(n)$. The aim of this paper is to show that (1.1) admits solutions of the form $x(t+T) = Qx(t), \forall t \in \mathbb{R}$. Usually, we call this type of solutions the rotating periodic solutions of (1.1). This kind of solutions might be periodic if $Q = I_n$, where I_n denotes the identity matrix in \mathbb{R}^n , subharmonic if $Q^k = I_n$ for some $k \in \mathbb{Z}^+$ with $k \geq 2$, and quasi-periodic if $Q^k \neq I_n$ for any $k \in \mathbb{Z}^+$ with $k \geq 1$.

The existence of periodic solutions for second order Hamiltonian systems has been extensively studied in the past thirty years (see [2, 9, 10, 12, 13] and references therein). Recently, the rotating periodic solutions for nonlinear differential equations has become a very interesting topic. In [3, 4], Chang and Li studied the second order dynamical systems, by using the coincidence degree they obtained some existence results of rotating periodic solutions. In [6], Hu et al build up some important stability criteria for rotating periodic solutions of Hamiltonian systems using the Maslov index theory. In [7], by using Morse theory and the technique of penalized functional, we obtained one nontrivial rotating periodic solutions for a class of asymptotically linear second order Hamiltonian systems with resonance at infinity.

In this paper, we shall study the existence and multiplicity of rotating periodic solutions for (1.1) via Morse theory when $V_x(t, x)$ is super-linear at infinity. We make the following assumptions:

- (H0) $V(t, x) \in C^2(\mathbb{R} \times \mathbb{R}^n, \mathbb{R})$ with $V(t, 0) = 0$ and $V(t+T, x) = V(t, Q^{-1}x)$ for some orthogonal matrix $Q \in O(n)$;

2010 *Mathematics Subject Classification.* 34C25, 37J45, 37B30 .

Key words and phrases. Second order Hamiltonian systems; rotating periodic solutions; Morse theory.

The first author is supported by Liaocheng University Doctoral Fund. The second author is supported by National Basic Research Program of China (grant No. 2013CB834100), NSFC (grant No. 11571065) and NSFC (grant No. 11171132). The third author is supported by NSFC (grant No. 11201173).

* Corresponding author.

Download English Version:

<https://daneshyari.com/en/article/8053940>

Download Persian Version:

<https://daneshyari.com/article/8053940>

[Daneshyari.com](https://daneshyari.com)