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Periodic Solutions for a Class of Superquadratic Damped Vibration Problems

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Abstract: In the present paper, the following damped vibration problems

$$\begin{cases} \ddot{u}(t) + q(t)\dot{u}(t) - L(t)u(t) + \nabla W(t, u(t)) = 0, \\ u(0) - u(T) = \dot{u}(0) - \dot{u}(T) = 0, \end{cases}$$

are studied, where $T > 0$, $q \in C(\mathcal{R}, \mathcal{R})$ is $T-$periodic with $\int_0^T q(t)dt = 0$, $L(t)$ is a continuous $T-$periodic and symmetric $N \times N$ matrix-valued function and $W \in C^1(\mathcal{R} \times \mathcal{R}^N, \mathcal{R})$ is $T-$periodic in the first variable. We use a new kind of superquadratic condition instead of the global Ambrosetti-Rabinowitz superquadratic condidition and we obtain a nontrivial $T-$periodic solution for the above system. The main idea here lies in the application of a variant of generalized weak linking theorem for strongly indefinite problem developed by Schechter and Zou.

Keywords: *periodic solutions; damped vibration problems; superquadradicity; weak linking theorem.*

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1 Introduction

Consider the following damped vibration problems

$$(\mathcal{DV}) \qquad \begin{cases} \ddot{u}(t) + q(t)\dot{u}(t) - L(t)u(t) + \nabla W(t, u(t)) = 0, \\ u(0) - u(T) = \dot{u}(0) - \dot{u}(T) = 0, \end{cases}$$

where $T > 0$, $q : \mathcal{R} \longrightarrow \mathcal{R}$ is a continuous $T-$periodic function with $\int_0^T q(t)dt = 0$, $Q(t) = \int_0^t q(s)ds$, $L(t)$ is a continuous $T-$periodic and symmetric $N \times N$ matrix-valued

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