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Homoclinic Orbits for Damped Vibration Systems with Small Forcing Terms

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Abstract: We study the existence of homoclinic orbits for second order non-autonomous damped vibration system

$$\ddot{q}(t) + B\dot{q}(t) + V'(t, q(t)) = f(t),$$

where B is a skew-symmetric constant matrix, $t \in \mathbb{R}$, $q \in \mathbb{R}^N$ and $\mathrm{V} \in C^1(\mathbb{R}\times\mathbb{R}^N, \mathbb{R})$, $V(t, q) = -K(t, q) + W(t, q)$ is T-periodic with respect to t, $T > 0$. We assume that $W(t, q)$ satisfies an assumption weaker than the global Ambrosetti-Rabinowitz condition and that the norm of B is sufficiently small. This homoclinic orbit is obtained as a limit of $2kT$-periodic solutions of a certain sequence of second order differential equations. This result generalizes and improves some existing findings in the known literature.

Keywords: *vector field; homoclinic orbits; damped vibration systems; mountain pass theorem; critical points; minimax methods.*

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1 Introduction and Main Results

We consider the following system

$$\ddot{q}(t) + B\dot{q}(t) + V'(t, q(t)) = f(t), \qquad (DS)$$

where B is a skew-symmetric constant matrix, $V : \mathbb{R} \times \mathbb{R}^N \to \mathbb{R}$, $(t, x) \to V(t, x)$ is a continuous function, T-periodic in the first variable with $T > 0$ and differentiable with respect to the second variable such that $V'(t, x) = \frac{\partial V}{\partial x}(t, x)$ is continuous on $\mathbb{R} \times \mathbb{R}^N$

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