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Existence and location of periodic solutions to convex and non coercive Hamiltonian systems. (English) Zbl 1082.34012

Discrete Contin. Dyn. Syst. 12, No. 5, 983-996 (2005).

Here, the following boundary value problem for Hamiltonian systems is studied

$$J\dot{u}(t) + \nabla H(t, u(t)) = 0 \quad \text{a.e. on } [0,T], \quad u(0) = u(T),$$

where the function $H : [0,T] \times \mathbb{R}^{2N} \to \mathbb{R}$ is called Hamiltonian and J is a symplectic $2N \times 2N$-matrix. Special attention is given to the case in which the Hamiltonian H, besides being measurable on $t \in [0,T]$, is convex and continuously differentiable with respect to $u \in \mathbb{R}^{2N}$. The basic assumption is that the Hamiltonian H satisfies the following growth condition:

Let $p \in (1,2)$ and $q = \frac{p}{p-1}$. There exist positive constants α, $\overline{\alpha}$ and functions $\beta, \gamma \in L^q(0,T;\mathbb{R}^+)$ such that

$$\delta|u| - \beta(t) \leq H(t,u) \leq \tfrac{\alpha}{q}|u|^q + \gamma(t)$$

for all $u \in \mathbb{R}^{2N}$ and a.e. $t \in [0,T]$. The main result assures that under suitable bounds on α, δ and the functions β, γ, the problem above has at least a solution that belongs to $W_T^{1,p}$. Such a solution corresponds, in the duality, to a function that minimizes the dual action restricted to a subset of $\widetilde{W}_T^{1,p} = \{v \in W_T^{1,p} : \int_0^T v(t)\,dt = 0\}$.

Reviewer: Vasile Marinca (Timişoara)

MSC:

34B15	Nonlinear boundary value problems for ordinary differential equations	Cited in **11** Documents
34C25	Periodic solutions to ordinary differential equations	
37J45	Periodic, homoclinic and heteroclinic orbits; variational methods, degree-theoretic methods (MSC2010)	

Keywords:

Hamiltonian; dual action; convex and noncoercive Hamiltonian systems; periodic solutions

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