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Numerical Research of Periodic Solutions for a Class of Noncoercive Hamiltonian Systems

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Abstract: In this paper, we are interested in the existence of periodic solutions and approximative solutions to the Hamiltonian system $\dot{x} = JH'(t,x)$ when H is non-coercive of the type $H(t,r,p) = G(p - Ar) + h(t) \cdot (r,p)$. For the proof we use the Dual Action Principle and Critical Point Theory.

Keywords: *Hamiltonian systems; periodic solutions; non-coercive; dual action principle; discrete dual action principle; critical point theory; numerical research.*

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1 Introduction

Let $G : \mathbb{R}^n \longrightarrow \mathbb{R}$ be a continuously differentiable function such that $G' : \mathbb{R}^n \longrightarrow G'(\mathbb{R}^n)$ be an homeomorphism. Let A be a matrix of order n and $h : \mathbb{R} \longrightarrow \mathbb{R}^n$ be a continuous $T-$ periodic $(T > 0)$ function with zero mean value. Consider the non-coercive Hamiltonian

$$H(t,r,p) = G(p - Ar) + h(t) \cdot (r,p).$$

Here $x.y$ is the usual inner product of $x, y \in \mathbb{R}^{2n}$. We are interested in the boundary value problem

$$\dot{x} = JH'(t,x) \qquad (\mathcal{H})$$

with

$$x(0) = x(T). \qquad (\mathcal{C})$$

The goal of this work is to prove the existence of solutions to the problem $(\mathcal{H})(\mathcal{C})$ and to approximate these solutions.

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