

EXISTENCE OF NONTRIVIAL PERIODIC SOLUTIONS FOR A CLASS OF p -HAMILTONIAN SYSTEMS

TAI-JIN ZHAO AND CHUN LI*

Abstract. In this paper, we investigate a class of p -Hamiltonian systems. By means of the Mountain Pass Lemma, we obtain the existence of one nontrivial periodic solution under some new conditions.

Mathematics subject classification (2020): 34A34, 34C25, 35A15, 35B38.

Keywords and phrases: Periodic solutions, p -Hamiltonian systems, (C) condition, variational methods.

REFERENCES

- [1] A. AMBROSETTI AND P. H. RABINOWITZ, *Dual variational methods in critical point theory and applications*, J. Funct. Anal., **14**, 4 (1973), 349–381.
- [2] P. BARTOLO AND V. BENCI, D. FORTUNATO, *Abstract critical point theorems and applications to some nonlinear problems with strong resonance at infinity*, Nonlinear Anal., **7**, 9 (1983), 981–1012.
- [3] K.-C. CHANG, *Infinite-dimensional Morse theory and multiple solution problems*, Progress in Nonlinear Differential Equations and their Applications, Birkhäuser Boston, Inc., Boston, MA, 1993.
- [4] G. CHEN AND S. MA, *Periodic solutions for Hamiltonian systems without Ambrosetti-Rabinowitz condition and spectrum 0*, J. Math. Anal. Appl., **379**, 2 (2011), 842–851.
- [5] I. EKELAND, *Convexity method in Hamiltonian mechanics*, Ergeb. Math. Grenzgeb. (3), 19 Results in Mathematics and Related Areas (3), Springer-Verlag, Berlin, 1990.
- [6] I. EKELAND AND H. HOFER, *Periodic solutions with prescribed period for convex autonomous Hamiltonian systems*, Invent. Math., **81**, 1 (1985), 155–188.
- [7] G. FEI, *On periodic solutions of superquadratic Hamiltonian systems*, Electron. J. Differential Equations, **2002**, 8 (2002), 1–12.
- [8] P. JEBELEAN AND N. S. PAPAGEORGIOU, *On noncoercive periodic systems with vector p -Laplacian*, Topol. Methods Nonlinear Anal., **38**, 2 (2011), 249–263.
- [9] X.-F. KE AND J.-F. LIAO, *On the existence of periodic solutions to second order Hamiltonian systems*, Electron. J. Qual. Theory Differ. Equ., **2022**, 36 (2022), 1–12.
- [10] C. LI, R. P. AGARWAL, Y. PU AND C.-L. TANG, *Nonconstant periodic solutions for a class of ordinary p -Laplacian systems*, Bound. Value Probl., **2016**, 213 (2016), 1–12.
- [11] C. LI, R. P. AGARWAL AND C.-L. TANG, *Infinitely many periodic solutions for ordinary p -Laplacian systems*, Adv. Nonlinear Anal., **4**, 4 (2015), 251–261.
- [12] S. MA, *Computations of critical groups and periodic solutions for asymptotically linear Hamiltonian systems*, J. Differential Equations, **248**, 10 (2010), 2435–2457.
- [13] S. MA AND Y. ZHANG, *Existence of infinitely many periodic solutions for ordinary p -Laplacian systems*, J. Math. Anal. Appl., **351**, 1 (2009), 469–479.
- [14] J. MAWHIN AND M. WILLEM, *Critical point theory and Hamiltonian systems*, Applied Mathematical Sciences, Springer-Verlag, New York, 1989.
- [15] P. H. RABINOWITZ, *Periodic solutions of Hamiltonian systems*, Comm. Pure Appl. Math., **31**, 2 (1978), 157–184.
- [16] P. H. RABINOWITZ, *On subharmonic solutions of Hamiltonian systems*, Comm. Pure Appl. Math., **33**, 5 (1980), 609–633.

- [17] M. SCHECHTER, *Periodic solutions of second-order nonautonomous dynamical systems*, Bound. Value Probl., **2006**, (2006), 1–9.
- [18] C.-L. TANG, *Periodic solutions of non-autonomous second order systems with γ -quasisubadditive potential*, J. Math. Anal. Appl., **189**, 3 (1995), 671–675.
- [19] C.-L. TANG, *Periodic solutions for nonautonomous second systems with sublinear nonlinearity*, Proc. Amer. Math. Soc., **126**, 11 (1998), 3263–3270.
- [20] C.-L. TANG AND X.-P. WU, *Notes on periodic solutions of subquadratic second order systems*, J. Math. Anal. Appl., **285**, 1 (2003), 8–16.
- [21] X. TANG AND Q. MENG, *Solutions of a second-order Hamiltonian system with periodic boundary conditions*, Nonlinear Anal. Real World Appl., **11**, 5 (2010), 3722–3733.
- [22] X. TANG AND X. ZHANG, *Periodic solutions for second-order Hamiltonian systems with a p -Laplacian*, Ann. Univ. Mariae Curie-Skłodowska Sect. A, **64**, 1 (2010), 93–113.
- [23] Y. TIAN AND W. GE, *Periodic solutions of non-autonomous second-order systems with a p -Laplacian*, Nonlinear Anal., **66**, 1 (2007), 192–203.
- [24] X.-P. WU AND C.-L. TANG, *Periodic solutions of a class of non-autonomous second-order systems*, J. Math. Anal. Appl., **236**, 2 (1999), 227–235.
- [25] B. XU AND C.-L. TANG, *Some existence results on periodic solutions of p -Laplacian systems*, J. Math. Anal. Appl., **333**, 2 (2007), 1228–1236.
- [26] Q. ZHANG AND X. TANG, *New existence of periodic solutions for second order non-autonomous Hamiltonian systems*, J. Math. Anal. Appl., **369**, 1 (2010), 357–367.
- [27] X. ZHANG AND X. TANG, *Periodic solutions for an ordinary p -Laplacian system*, Taiwanese J. Math., **15**, 3 (2011), 1369–1396.
- [28] X. ZHANG AND X. TANG, *Periodic solutions for second order Hamiltonian system with a p -Laplacian*, Bull. Belg. Math. Soc. Simon Stevin, **18**, 2 (2011), 301–309.
- [29] X. ZHANG AND X. TANG, *Non-constant periodic solutions for second order Hamiltonian system with a p -Laplacian*, Math. Slovaca, **62**, 2 (2012), 231–246.
- [30] X. ZHANG AND X. TANG, *Existence of subharmonic solutions for non-quadratic second-order Hamiltonian systems*, Bound. Value Probl., **2013**, 1 (2013), 1–25.
- [31] X. ZHANG AND P. ZHOU, *An existence result on periodic solutions of an ordinary p -Laplace system*, Bull. Malays. Math. Sci. Soc., **34**, 1 (2011), 127–135.
- [32] X. ZHANG AND Y. ZHOU, *Periodic solutions of non-autonomous second order Hamiltonian systems*, J. Math. Anal. Appl., **345**, 2 (2008), 929–933.