

## Existence of three solutions for a three-point boundary value problem via a three-critical-point theorem

XIAOJIE LIN

### ABSTRACT.

In this paper, we study the existence of at least three solutions for a three-point boundary value problem. By constructing and showing an appropriate separable and reflexive Banach space, a new multiplicity result of the three-point boundary value problem is established. Our main tool is based upon variational method and three-critical-point theorem.

**Acknowledgements.** The author expressed her sincere thanks to the anonymous reviewer for his or her valuable comments and suggestions for improving the quality of the paper. This work is supported by the Natural Science Foundation of China (Grant No. 11471146).

### REFERENCES

- [1] Bonanno, G., *Existence of three solutions for a two point boundary value problem*, Appl. Math. Lett., **13** (2000), 53–57
- [2] Bonanno, G. and Livrea, B., *Multiplicity theorems for the Dirichlet problem involving the  $P$ -Laplacian*, Nonlinear Anal., **54** (2003), 1–7
- [3] Candito, P., *Existence of three solutions for a nonautonomous two point boundary value problem*, J. Math. Anal. Appl., **252** (2000), 532–537
- [4] Du, Z., Xue, C. and Ge, W., *Multiple Solutions for Three-Point Boundary Value Problem with Nonlinear terms Depending on the First Order Derivative*, Arch. Math., **84** (2005), 341–349
- [5] Du, Z., Lin, X. and Tisdell Christopher C., *A multiplicity result for  $p$ -Laplacian boundary value problems via critical points theorem*, Appl. Math. Comput., **205** (2008), 231–237
- [6] He, X. and Ge, W., *Existence of three solutions for a quasilinear two-point boundary value problem*, Computers Math. Applic., **45** (2003), 765–769
- [7] He, X. and Ge, W., *Triple solutions for second order three-point boundary value problems*, J. Math. Anal. Appl., **268** (2002), 256–265
- [8] Livrea, B., *Existence of three solutions for a quasilinear two-point boundary value problem*, Arch. Math., **79** (2002), 288–298
- [9] Ma, R., *Positive solutions for second order three-point boundary value problems*, Appl. Math. Lett., **14** (2001), 1–5
- [10] Ma, R., *Multiplicity results for a three-point boundary value problems at resonance*, Nonlinear Anal., **53** (2003), 777–789
- [11] Mawhin, J. and Willem, M., *Critical points theory and Hamiltonian systems*, Springer-Verlag, Berlin, 1989
- [12] Ricceri, B., *On a three critical points theorem*, Arch. Math., **75** (2000), 220–226
- [13] Ricceri, B., *Existence of three solutions for a class of elliptic eigenvalue problems*, Math. Comput. Modelling, **32** (2000) 1485–1494
- [14] Ricceri, B., *A new method for the study of nonlinear eigenvalue problems*, C. R. Acad. Sci. Paris, Sér. I, **328** (1999), 251–256
- [15] Yosida, K., *Functional analysis (sixth edition)*, Springer-Verlag, Berlin, 1980

Received: 11.07.2013; In revised form: 05.06.2014; Accepted: 15.06.2014

2010 Mathematics Subject Classification. 34B15.

Key words and phrases. Three-point boundary value problem, three-critical-point theorem, three solutions, eigenvalue problem.

JIANGSU NORMAL UNIVERSITY  
SCHOOL OF MATHEMATICS AND STATISTICS,  
XUZHOU, JIANGSU 221116, P. R. CHINA  
*E-mail address:* linxiaojie1973@163.com