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EXISTENCE OF THREE WEAK SOLUTIONS FOR A CLASS OF DISCRETE PROBLEMS DRIVEN BY p-LAPLACIAN OPERATOR

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Abstract. In this paper, by using a theorem based on variational method which was recently proved by Ricceri, we establish the existence of three weak solutions for a class of p-Laplacian discrete problems. Remarks and examples are provided to illustrate our result.
Key Words and Phrases: Discrete boundary value problem, p-Laplacian discrete equations, three solutions, critical point theory.
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References

[1] F.M. Atici, A. Cabada, *Existence and uniqueness results for discrete second-order periodic boundary value problems*, Comput. Math. Appl., **45**(2003), 1417-1427.
[2] F.M. Atici, G.Sh. Guseinov, *Positive periodic solutions for nonlinear difference equations with periodic coefficients*, J. Math. Anal. Appl., **232**(1999), 166-182.
[3] G. Bonanno, P. Candito, *Nonlinear difference equations investigated via critical point methods*, Nonlinear Anal. TMA, **70**(2009), 3180-3186.
[4] G. Bonanno, P. Jebelean, C. Şerban, *Three solutions for discrete anisotropic periodic and Neumann problems*, Dynamic Sys. Appl., **22**(2013), 183-196.
[5] A. Cabada, A. Iannizzotto, S. Tersian, *Multiple solutions for discrete boundary value problem*, J. Math. Anal. Appl., **356**(2009), 418-428.
[6] J. Chu, D. Jiang, *Eigenvalues and discrete boundary value problems for the one-dimensional p-Laplacian*, J. Math. Anal. Appl., **305**(2005), 452-465.
[7] M. Galewski, S. Heidarkhani, A. Salari, *Multiplicity results for discrete anisotropic equations*, Discrete Contin. Dyn. Syst. Ser. B, **23**(2018), 203-218.
[8] J.R. Graef, S. Heidarkhani, L. Kong, A. Salari, *Three weak solutions to a degenerate quasilinear elliptic system*, Le Matematiche, **74**(2019), no. 1, 191-210.
[9] S. Heidarkhani, G.A. Afrouzi, J. Henderson, S. Moradi, G. Caristi, *Variational approaches to p-Laplacian discrete problems of Kirchhoff type*, J. Differ. Equ. Appl., **23**(2017), 917-938.
[10] S. Heidarkhani, G.A. Afrouzi, M. Imbesi, S. Moradi, *Existence of three weak solutions for a perturbed anisotropic discrete Dirichlet problem*, Appl. Anal., **98**(2019), no. 3, 561-580.

[11] S. Heidarkhani, M. Imbesi, *Multiple solutions for partial discrete Dirichlet problems depending on a real parameter*, J. Diff. Equat. Appl., **21**(2015), no. 2, 96-110.
[12] S. Heidarkhani, M. Imbesi, *Nontrivial solutions for partial discrete Dirichlet problems via a local minimum theorem for functionals*, J. Nonlin. Funct. Anal., **2019**(2019), art. ID 42, 1-14.
[13] J. Henderson, H.B. Thompson, *Existence of multiple solutions for second order discrete boundary value problems*, Comput. Math. Appl., **43**(2002), 1239-1248.
[14] M. Imbesi, G. Molica Bisci, *Discrete elliptic Dirichlet problems and nonlinear algebraic systems*, Mediterr. J. Math., **13**(2016), no. 1, 263-278.
[15] L. Jiang, Z. Zhou, *Three solutions to Dirichlet boundary value problems for p-Laplacian difference equations*, Adv. Diff. Equ., **2008**(2008), 1-10.
[16] W.G. Kelly, A.C. Peterson, *Difference Equations: An Introduction with Applications*, Academic Press, San Diego, New York, Basel, 1991.
[17] G. Molica Bisci, A. Pansera, *Three weak solutions for nonlocal fractional equations*, Adv. Nonlinear Stud., **14**(2014), 619-629.
[18] G. Molica Bisci, D. Repovš, *Existence of solutions for p-Laplacian discrete equations*, Applied Math. Comput., **242**(2014), 454-461.
[19] B. Ricceri, *A further refinement of a three critical points theorem*, Nonlinear Anal. TMA, **74**(2011), 7446-7454.
[20] D.B. Wang, W. Guan, *Three positive solutions of boundary value problems for p-Laplacian difference equations*, Comput. Math. Appl., **55**(2008), 1943-1949.

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