IMPULSIVE NABLA FRACTIONAL DIFFERENCE EQUATIONS

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Abstract. This article deals with the study of impulsive nabla fractional difference equations. First, we present a first-order initial value problem (IVP) on impulsive nabla difference equations and write its equivalent sum equation. To illustrate the proposed procedure, we provide an example. In this line, we propose a particular class of IVPs for α^{th}-order $(0 < \alpha \leqslant 1)$ impulsive nabla difference equations in the Caputo sense and establish its equivalent sum equation. We furnish an eigenvalue problem to demonstrate the proposed method. Next, we introduce a special class of αth-order $(0 < \alpha \leqslant 1)$ impulsive nabla boundary value problems (BVPs) and analyse its solutions, using fixed point theorems. Finally, we support this analysis through a few examples.

REFERENCES

[1] T. ABDELJAWAD AND F. M. ATICI, *On the definitions of nabla fractional operators*, Abstr. Appl. Anal. **2012**, Art. ID 406757 (2012), 13 pp.

[2] R. P. AGARWAL, M. MEEHAN AND D. O'REGAN, *Fixed Point Theory and Applications*, Cambridge Tracts in Mathematics **141**, Cambridge University Press, Cambridge, 2001.

[3] B. AHMAD AND S. SIVASUNDARAM, *Existence results for nonlinear impulsive hybrid boundary value problems involving fractional differential equations*, Nonlinear Anal. Hybrid Syst. **3**, 3 (2009), 251–258.

[4] G. A. ANASTASSIOU, *Nabla discrete fractional calculus and nabla inequalities*, Math. Comput. Modelling **51**, 5–6 (2010), 562–571.

[5] F. M. ATICI AND P. W. ELOE, *Two-point boundary value problems for finite fractional difference equations*, J. Difference Equ. Appl. **17**, 4 (2011), 445–456.

[6] D. BAĬNOV AND P. SIMEONOV, *Impulsive Differential Equations: Periodic Solutions and Applications*, Pitman Monographs and Surveys in Pure and Applied Mathematics **66**, Longman Scientific & Technical, Harlow; copublished in the United States with John Wiley & Sons, Inc., New York, 1993.

[7] M. BENCHOHRA, J. HENDERSON AND S. NTOUYAS, *Impulsive Differential Equations and Inclusions*, Contemporary Mathematics and Its Applications **2**, Hindawi Publishing Corporation, New York, 2006.

[8] H. BEREKETOGLU AND A. HUSEYNOV, *Boundary value problems for nonlinear second-order difference equations with impulse*, Appl. Math. Mech. (English Ed.) **30**, 8 (2009), 1045–1054.

[9] M. BOHNER AND A. PETERSON, *Dynamic Equations on Time Scales. An Introduction with Applications*, Birkhäuser Boston, Inc., Boston, MA, 2001.

[10] M. FEČKAN, Y. ZHOU AND J. WANG, *On the concept and existence of solution for impulsive fractional differential equations*, Commun. Nonlinear Sci. Numer. Simul. **17**, 7 (2012), 3050–3060.

[11] C. GOODRICH AND A. C. PETERSON, *Discrete Fractional Calculus*, Springer, Cham, 2015.

[12] Z. HE AND X. ZHANG, *Monotone iterative technique for first order impulsive difference equations with periodic boundary conditions*, Appl. Math. Comput. **156**, 3 (2004), 605–620.

[13] W. G. KELLEY AND A. C. PETERSON, *Difference Equations. An Introduction with Applications*, Second edition, Harcourt/Academic Press, San Diego, CA, 2001.

[14] A. A. Kilbas, H. M. Srivastava and J. J. Trujillo, *Theory and Applications of Fractional Differential Equations*, North-Holland Mathematics Studies **204**, Elsevier Science B.V., Amsterdam, 2006.

[15] V. Lakshmikantham, D. Baĭnov and P. Simeonov, *Theory of impulsive Differential Equations*, Series in Modern Applied Mathematics **6**, World Scientific Publishing Co., Inc., Teaneck, NJ, 1989.

[16] J. Li and J. Shen, *Positive solutions for first order difference equations with impulses*, Int. J. Difference Equ. **1**, 2 (2006), 225–239.

[17] I. Podlubny, *Fractional Differential Equations*, Mathematics in Science and Engineering **198**, Academic Press, Inc., San Diego, CA, 1999.

[18] D. R. Smart, *Fixed Point Theorems*, Cambridge Tracts in Mathematics **66**, Cambridge University Press, London-New York, 1974.

[19] J. Wang, Y. Zhou and M. Fečkan, *Nonlinear impulsive problems for fractional differential equations and Ulam stability*, Comput. Math. Appl. **64**, 10 (2012), 3389–3405.

[20] J. Wang, M. Fečkan and Y. Zhou, *A survey on impulsive fractional differential equations*, Fract. Calc. Appl. Anal. **19**, 4 (2016), 806–831.

[21] P. Wang and W. Wang, *Boundary value problems for first order impulsive difference equations*, Int. J. Difference Equ. **1**, 2 (2006), 249–259.

[22] G. Wu and D. Baleanu, *Stability analysis of impulsive fractional difference equations*, Fract. Calc. Appl. Anal. **21**, 2 (2018), 354–375.

[23] G. Wu, D. Zeng and D. Baleanu, *Fractional impulsive differential equations: exact solutions, integral equations and short memory case*, Fract. Calc. Appl. Anal. **22**, 1 (2019), 180–192.

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