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FRACTIONAL ITERATIVE FUNCTIONAL DIFFERENTIAL EQUATIONS WITH IMPULSES

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Abstract. In this paper, a class of impulsive fractional iterative functional differential equations is studied. By applying the Schauder fixed point theorem, the first existence result of solutions is presented. By applying the Picard operators methods, the second existence, uniqueness and data dependence results are also established.

Key Words and Phrases: Impulses, iterative functional differential equations, existence, uniqueness, data dependence, fixed point.

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References

- R.P. Agarwal, M. Benchohra, S. Hamani, A survey on existence results for boundary value problems of nonlinear fractional differential equations and inclusions, Acta. Appl. Math., 109(2010), 973-1033.
- [2] B. Ahmad, S. Sivasundaram, Existence results for nonlinear impulsive hybrid boundary value problems involving fractional differential equations, Nonlinear Anal., Hybrid Systems 3(2009), 251-258.
- B. Ahmad, S. Sivasundaram, Existence of solutions for impulsive integral boundary value problems of fractional order, Nonlinear Anal., HS, 4(2010), 134-141.
- B. Ahmad, G. Wang, Impulsive anti-periodic boundary value problem for nonlinear differential equations of fractional order, Comput. Math. Appl., 59(2010), 1341-1349.
- [5] K. Balachandran, S. Kiruthika, Existence of solutions of abstract fractional impulsive semilinear evolution equations, Electr. J. Qualitative Theory of Diff. Equ., 2010(2010), no. 4, 1-12.
- [6] M. Benchohra, D. Seba, Impulsive fractional differential equations in Banach spaces, Electr. J. Qualitative Theory of Diff. Equ., Spec. Ed. I, 2009(2009), no. 8, 1-14.
- [7] J. Cao, H. Chen, Some results on impulsive boundary value problem for fractional differential inclusions, Electr. J. Qualitative Theory of Diff. Equ., 2010(2010), no. 11, 1-24.

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- [8] J. Cao, H. Chen, Impulsive fractional differential equations with nonlinear boundary conditions, Math. Comput. Model., 55(2012), 303-311.
- [9] M. Fečkan, Y. Zhou, J. Wang, On the concept and existence of solution for impulsive fractional differential equations, Commun. Nonlinear Sci. Numer. Simulat., 17(2012), 3050-3060.
- [10] A. A. Kilbas, H. M. Srivastava, J. J. Trujillo, *Theory and applications of fractional differential equations*, in: North-Holland Mathematics Studies, vol. 204, Elsevier Science B.V., Amsterdam, 2006.
- [11] N. Kosmatov, Initial value problems of fractional order with fractional impulsive conditions, Results. Math., 63(2013), no.3, 1289-1310.
- [12] V. Mureşan, Existence, uniqueness and data dependence for the solutions of some integrodifferential equations of mixed type in Banach space, J. Anal. Appl., 23(2004), 205-216.
- [13] V. Mureşan, Volterra integral equations with iterations of linear modification of the argument, Novi Sad J. Math., 33(2003), 1-10.
- [14] I.M. Olaru, An integral equation via weakly Picard operators, Fixed Point Theory, 11(2010), 97-106.
- [15] I.A. Rus, Metrical Fixed Point Theorems, Univ. of Cluj-Napoca, Romania, 1979.
- [16] I.A. Rus, *Picard mappings: results and problems*, Preprint. Cluj-Napoca: Babeş-Bolyai Univ., Seminar on Fixed Point Theory, Preprint 6(1987), 55-64.
- [17] I.A. Rus, Weakly Picard mappings, Comment. Math. Univ. Carolinae, 34(1993), 769-773.
- [18] I.A. Rus, S. Mureşan, Data dependence of the fixed points set of some weakly Picard operators, In: Proc. Itinerant Seminar (Elena Popoviciu editor, Srima Publishing House), Cluj-Napoca, Romaniam Babeş-Bolyai Univ., 2000, 201-207.
- [19] I.A. Rus, Functional-differential equations of mixed type, via weakly Picard operators, Seminar on fixed point theory, Cluj-Napoca, 2002, 335-345.
- [20] I.A. Rus, Picard operators and applications, Sci. Math. Jpn., 58(2003), 191-219.
- [21] I.A. Rus, E. Egri, Boundary value problems for iterative functional-differential equations, Studia Univ. "Babeş-Bolyai", Mathematica, 51(2006), 109-126.
- [22] M.A. Şerban, I.A. Rus, A. Petruşel, A class of abstract Volterra equations, via weakly Picard operators technique, Math. Ineq. Appl., 13(2010), 255-269.
- [23] Y. Tian, Z. Bai, Existence results for the three-point impulsive boundary value problem involving fractional differential equations, Comput. Math. Appl., 59(2010), 2601-2609.
- [24] G. Wang, B. Ahmad, L. Zhang, Impulsive anti-periodic boundary value problem for nonlinear differential equations of fractional order, Nonlinear Anal., 74(2011), 792-804.
- [25] G. Wang, L. Zhang, G. Song, Systems of first order impulsive functional differential equations with deviating arguments and nonlinear boundary conditions, Nonlinear Anal., 74(2011), 974-982.
- [26] G. Wang, B. Ahmad, L. Zhang, Some existence results for impulsive nonlinear fractional differential equations with mixed boundary conditions, Comput. Math. Appl., 59(2010), 1389-1397.
- [27] J. Wang, Y. Zhou, M. Medved, Picard and weakly Picard operators technique for nonlinear differential equations in Banach spaces, J. Math. Anal. Appl., 389(2012), 261-274.
- [28] J. Wang, Y. Zhou, M. Fečkan, On recent developments in the theory of boundary value problems for impulsive fractional differential equations, Comp. Math. Appl., 64(2012), 3008-3020.
- [29] J. Wang, Y. Zhou, M. Fečkan, Nonlinear impulsive problems for fractional differential equations and Ulam stability, Comp. Math. Appl., 64(2012), 3389-3405.
- [30] J. Wang, X. Li, W. Wei, On the natural solution for an impulsive fractional differential equations of order $q \in (1, 2)$, Commun. Nonlinear Sci. Numer. Simulat., **17**(2012), 4384-4394.
- [31] X. Wang, Impulsive boundary value problem for nonlinear differential equations of fractional order, Comput. Math. Appl., 62(2011), 2383-2391.
- [32] L. Yang, H. Chen, Nonlocal boundary value problem for impulsive differential equations of fractional order, Adv. Differ. Eq., 2011(2011), Article ID 404917, 16 pp.

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