

Existence of solutions for a fractional nonlocal boundary value problem

RODICA LUCA

ABSTRACT.

We investigate the existence of solutions for a Riemann-Liouville fractional differential equation with a nonlinearity dependent of fractional integrals, subject to nonlocal boundary conditions which contain various fractional derivatives and Riemann-Stieltjes integrals. In the proof of our main results we use different fixed point theorems.

Acknowledgement. The author thanks the referee for his/her valuable comments and suggestions.

REFERENCES

- [1] Agarwal, R. P. and Luca, R., *Positive solutions for a semipositone singular Riemann-Liouville fractional differential problem*, Inter. J. Nonlinear Sci. Num. Simul., **20** (2019), (7-8), 823–832
- [2] Ahmad, B. and Luca, R., *Existence of solutions for a sequential fractional integro-differential system with coupled integral boundary conditions*, Chaos Solitons Fractals, **104** (2017), 378–388
- [3] Ahmad, B. and Luca, R., *Existence of solutions for a system of fractional differential equations with coupled nonlocal boundary conditions*, Fract. Calc. Appl. Anal., **21** (2018), No. 2, 423–441
- [4] Ahmad, B. and Luca, R., *Existence of solutions for sequential fractional integro-differential equations and inclusions with nonlocal boundary conditions*, Appl. Math. Comput., **339** (2018), 516–534
- [5] Ahmad B. and Ntouyas, S. K., *Existence results for a coupled system of Caputo type sequential fractional differential equations with nonlocal integral boundary conditions*, Appl. Math. Comput., **266** (2015), 615–622
- [6] Aljoudi, S., Ahmad, B., Nieto, J. J. and Alsaedi, A., *A coupled system of Hadamard type sequential fractional differential equations with coupled strip conditions*, Chaos Solitons Fractals, **91** (2016), 39–46
- [7] Guo, L., Liu, L. and Wu, Y., *Iterative unique positive solutions for singular p-Laplacian fractional differential equation system with several parameters*, Nonlinear Anal. Model. Control, **23** (2018), No. 2, 182–203
- [8] Henderson, J. and Luca, R., *Boundary Value Problems for Systems of Differential, Difference and Fractional Equations. Positive solutions*, Elsevier, Amsterdam, 2016
- [9] Henderson, J. and Luca, R., *Existence of positive solutions for a singular fractional boundary value problem*, Nonlinear Anal. Model. Control, **22** (2017), No. 1, 99–114
- [10] Henderson, J. and Luca, R., *Systems of Riemann-Liouville fractional equations with multi-point boundary conditions*, Appl. Math. Comput., **309** (2017), 303–323
- [11] Henderson, J., Luca, R. and Tudorache, A., *On a system of fractional differential equations with coupled integral boundary conditions*, Fract. Calc. Appl. Anal., **18** (2015), No. 2, 361–386
- [12] Henderson, J., Luca, R. and Tudorache, A., *Existence and nonexistence of positive solutions for coupled Riemann-Liouville fractional boundary value problems*, Discrete Dyn. Nature Soc., **2016** Article ID 2823971 (2016), 1–12
- [13] Krasnosel'skii, M. A., *Two remarks on the method of successive approximations*, Uspekhi Mat. Nauk. **10** (1955), 123–127

Received: 19.04.2019; In revised form: 31.01.2020; Accepted: 07.02.2020

2010 *Mathematics Subject Classification.* 34A08, 45G15.

Key words and phrases. Riemann-Liouville fractional differential equation, fractional integrals, nonlocal boundary conditions, existence of solutions.

- [14] Liu, L., Li, H., Liu, C. and Wu, Y., *Existence and uniqueness of positive solutions for singular fractional differential systems with coupled integral boundary value problems*, J. Nonlinear Sci. Appl., **10** (2017), 243–262
- [15] Liu, S., Liu, J., Dai, Q. and Li, H., *Uniqueness results for nonlinear fractional differential equations with infinite-point integral boundary conditions*, J. Nonlinear Sci. Appl., **10** (2017), 1281–1288
- [16] Luca, R., *Positive solutions for a system of Riemann-Liouville fractional differential equations with multi-point fractional boundary conditions*, Bound. Value Prob., **2017** (2017), No. 102, 1–35
- [17] Pu, R., Zhang, X., Cui, Y., Li, P. and Wang, W., *Positive solutions for singular semipositone fractional differential equation subject to multipoint boundary conditions*, J. Funct. Spaces, **2017**, Article ID 5892616 (2017), 1–7
- [18] Shen, C., Zhou, H. and Yang, L., *Positive solution of a system of integral equations with applications to boundary value problems of differential equations*, Adv. Difference Equ., **2016** (2016), No. 260, 1–26
- [19] Xu, J. and Wei, Z., *Positive solutions for a class of fractional boundary value problems*, Nonlinear Anal. Model. Control, **21** (2016), 1–17
- [20] Zhang, X., *Positive solutions for a class of singular fractional differential equation with infinite-point boundary conditions*, Appl. Math. Lett., **39** (2015), 22–27
- [21] Zhang, X. and Zhong, Q., *Triple positive solutions for nonlocal fractional differential equations with singularities both on time and space variables*, Appl. Math. Lett., **80** (2018), 12–19

DEPARTMENT OF MATHEMATICS
GH. ASACHI TECHNICAL UNIVERSITY
11 BLVD. CAROL I, 700506, IAȘI, ROMANIA
Email address: rluca@math.tuiasi.ro