

## POSITIVE SOLUTIONS OF M-POINT FRACTIONAL BOUNDARY VALUE PROBLEM ON THE HALF LINE

DONDU OZ AND ILKAY KARACA

*Abstract.* In this paper, six functionals fixed point theorem is used to investigate the existence of positive solutions for fractional-order nonlinear boundary value problems on the half line. As an application, an example is given to illustrate the main result.

*Mathematics subject classification (2010):* 26A33, 34A08, 34B15, 34B18, 47H10.

*Keywords and phrases:* Fractional calculus, boundary value problem, fixed point theorem, positive solutions, half line.

### REFERENCES

- [1] A. A. KILBAS, H. M. SRIVASTAVA AND J. J. TRUJILLO, *Theory and Applications of Fractional Differential Equations*, North-Holland Mathematics Studies 204 (2006).
- [2] C. ZHAI AND L. WANG, *Some existence, uniqueness results on positive solutions for a fractional differential equation with infinite-point boundary conditions*, *Nonlinear Anal. Model. Control* **22(4)** (2017), 566–567.
- [3] G. WANG, *Explicit iteration and unbounded solutions for fractional integral boundary value problem on an infinite interval*, *Appl. Math. Lett.* **47** (2015), 1–7.
- [4] I. PODLUBNY, *Fractional Differential Equations*, Academic Press (1999).
- [5] I. YASLAN AND M. GUNENDI, *Positive solutions of higher-order nonlinear multi-point fractional equations with integral boundary conditions*, *Fract. Calc. Appl. Anal.* **19(4)** (2016), 989–1009.
- [6] J. GRAEF, L. KONG, Q. KONG AND M. WANG, *Uniqueness of positive solutions of fractional boundary value problems with non-homogeneous integral boundary conditions*, *Fract. Calc. Appl. Anal.* **15(3)** (2012), 509–528.
- [7] K. ZHANG AND J. XU, *Unique positive solution for a fractional boundary value problem*, *Fract. Calc. Appl. Anal.* **16(4)** (2013), 937–948.
- [8] L. ZHANG, B. AHMAD, G. WANG, R. AGARWAL, M. AL-YAMI AND W. SHAMMAKH, *Nonlocal integrodifferential boundary value problem for nonlinear fractional differential equations on an unbounded domain*, *Abstr. Appl. Anal.* (2013), Article ID 813903.
- [9] M. DALIR AND M. BASHAUR, *Applications of fractional calculus*, *Appl. Math. Sci. (Ruse)* **4** (2010), 1021–1032.
- [10] M. REHMAN AND R. A. KHAN, *Existence and uniqueness of solutions for multi-point boundary value problems for fractional differential equations*, *Appl. Math. Lett.* **23(9)** (2010), 1038–1044.
- [11] N. ABEL, *Solution de quelques problèmes à l'aide d'intégrales définies*, *Mag. Naturv.* **1(2)** (1823), 1–27.
- [12] R. AVERY, J. HENDERSON AND D. O'REGAN, *Six functionals fixed point theorem*, *Commun. Appl. Anal.* **12(1)** (2008), 69–81.
- [13] R. I. AVERY, *A generalization of the Leggett-Williams fixed point theorem*, *Math. Sci. Res. HotLine* **3(7)** (1999), 9–14.
- [14] R. P. AGARWAL, D. O'REGAN AND M. MEEHAN, *Fixed Point Theory and Applications*, *Found. Phys. Cambridge University Press* (2004).
- [15] R. W. LEGGETT AND L. R. WILLIAMS, *Multiple positive fixed points of nonlinear operators on ordered Banach spaces*, *Indiana Univ. Math. J.* **28(4)** (1979), 673–688.

- [16] S. BANACH, *Sur les opérations dans les ensembles abstraits et leur application aux équations intégrales*, *Fund. Math* **3(1)** (1922), 133–181.
- [17] S. LIANG AND J. ZHANG, *Existence of Three Positive Solutions of  $m$ -point Boundary Value Problems for Some Nonlinear Fractional Differential Equations on an Infinite Interval*, *Comput. Math. Appl.* (2011), 3343–3354.
- [18] W. GE AND X. ZHAO, *Unbounded Solutions for a Fractional Boundary Value Problems on the Infinite Interval*, *Acta Appl. Math.* **109** (2008), 495–505.
- [19] X. LI, X. LIU, M. JIA AND L. ZHANG, *The positive solutions of infinite-point boundary value problem of fractional differential equations on the infinite interval*, *Adv. Difference Equ.* **126** (2017).
- [20] X. SU, *Boundary value problem for a coupled system of nonlinear fractional differential equations*, *Appl. Math. Lett.* **22(1)** (2009), 64–69.
- [21] X. YUE AND K. ZHANG, *Existence of solution for integral boundary value problems of fractional differential equations*, *Bound. Value Probl.* **151** (2018), 13 pp.
- [22] Y. GHOLAMI, *Existence of an Unbounded Solution for Multi-Point Boundary Value Problems of Fractional Differential Equations on an Infinite Domain*, *Fract. Differ. Calc.* **4(2)** (2014), 125–136.