J. Adv. Math. Stud.
Vol. **8**(2015), No. 1, 60-67
http://journal.fairpartners.ro

THE EXISTENCE OF SOLUTIONS FOR FRACTIONAL ORDER DIFFERENTIAL INCLUSIONS WITH AN ANTI-PERIODIC BOUNDARY CONDITION

M. MOGHADAM AND H. MOHAMMADI

Abstract. In this paper, we investigate the existence of (minimal and maximal) solutions for two fractional differential inclusions via an anti-periodic boundary value problem.

REFERENCES

[1] R.P. Agarwal and B. Ahmad: *Existence theory for anti-periodic boundary value problems of fractional differential equations and inclusions*, J. Appl. Math. Comput., **62**(2011), 1200-1214.

[2] R.P. Agarwal, J.P.C. Dos Santos and C. Cuevas: *Analytic Resolvent Operator and Existence Results for Fractional Integro-differential Equations*, J. Abstr. Differ. Equ. Appl., **2**(2012), No. 2, 26-47.

[3] R.P. Agarwal, Y. Zhou and Y. He: *Existence of fractional neutral functional differential equations*, Comput. Math. Appl., **59**(2010), 1095-1100.

[4] B. Ahmad: *Existence of solutions for fractional differential equations of order $q \in (2,3]$ with anti-periodic boundary conditions*, J. Appl. Math. Comput., **34**(2010), 385-391.

[5] B. Ahmad and J.J. Nieto: *Existence of solutions for anti-periodic boundary value problems involving fractional differential equations via Leray-Schauder degree theory*, Topol. Methods Nonlinear Anal., **35**(2010), 295-304.

[6] B. Ahmad and J.J. Nieto: *Anti-periodic fractional boundary value problems*, Comput. Math. Appl., **62**(2011), 1150-1156.

[7] H. Amann: *Order structures and fixed points*, ATTI 2° Sem. Anal. Funz. Appl., 1977.

[8] J. Aubin and A. Ceuina: *Differential Inclusions: set-valued maps and viability theory*, Springer-Verlag, 1984.

[9] Z. Bai and W. Sun: *Existence and multiplicity of positive solutions for singular fractional boundary value problems*, Comput. Math. Appl., **63**(2012), 1369-1381.

[10] D. Baleanu, R.P. Agarwal, H. Mohammadi and Sh. Rezapour: *Some existence results for a nonlinear fractional differential equation on partially ordered Banach spaces*, Bound. Value Probl., 2013, 2013:112.

[11] D. Baleanu, H. Mohammadi and Sh. Rezapour: *Some existence results on nonlinear fractional differential equations*, Philos. Trans. R. Soc. Lond. Ser. A Math. Phys. Eng. Sci., **371**(2013), 20120144.

[12] D. Baleanu, H. Mohammadi and Sh. Rezapour: *On a nonlinear fractional differential equation on partially ordered metric spaces*, Adv. Difference Equ., 2013, 2013:83.

[13] M. Benchohra and N. Hamidi: *Fractional order differential inclusions on the Half-Lin*, Surv. Math. Appl., **5**(2010), 99-111.

[14] K. Deimling: *Multi-valued differential equations*, Walter de Gruyter, Berlin, 1992.

Received: 14 September, 2014. *Revised*: 10 December, 2014.
2010 *Mathematics Subject Classification*: 26A33, 34B99.
Key words and phrases: Fixed point, fractional differential inclusion, Green function, perturbed boundary value problem.

©2015 Fair Partners Team for the Promotion of Science & Fair Partners Publishers

[15] B.C. Dhage: *Some algebraic fixed point theorems for multi-valued operators with applications*, Glob. J. Math. Math. Sci., **1**(2005), 96-125.
[16] B.C. Dhage: *On boundary-value problems for second order perturbed differential inclusions*, Appl. Anal., **84**(2005), No. 9, 953-970.
[17] B.C. Dhage: *Fixed point theorems for discontinuous multivalued operators on ordered spaces with applications*, Comput. Math. Appl., **51**(2006), 589-604.
[18] A.M.A. El-Sayed and A.G. Ibrahim: *Multivalued fractional differential equations*, Appl. Math. Comput., **68**(1995), 15-25.
[19] D. Guo and V. Lakshmikanthm: *Nonlinear problems in abstract cones*, Academic Press, 1988.
[20] S. Heikkila and V. Lakshmikantam: *Monotone iterative technique for nonlinear discontinuous differential equations*, Marcel Dekker, 1994.
[21] N. Heymans and I. Podlubny: *Physical interpretation of initial conditions for fractional differential equations with Riemann-Liouville fractional derivatives*, Rheol. Acta, **45**(2006), No. 5, 765-772.
[22] F. Metzler, W. Schick, H.G. Kilian and T.F. Nonnenmacher: *Relaxation in filled polymers: a fractional calculus approach*, J. Chem. Phys., **103**(1995), 7180-7186.
[23] A.A. Kilbas, H.M. Srivastava and J.J. Trujillo: *Theory and applications of fractional differential equations*, North-Holland Mathematics Studies, Elsevier Science, 2006.
[24] V. Lakshmikantham, S. Leela and J. Vasundhara: *Theory of Fractional Dynamic Systems*, Cambridge Academic Publishers, 2009.
[25] A. Lasota and Z. Opial: *An application of the Kakutani-Ky Fan theorem in the theory of ordinary differential equations*, Bull. Acad. Pol. Sci. Set. Sci. Math. Astronom. Phy., **13**(1965), 781-786.
[26] H. Mohammadi and Sh. Rezapour: *Two existence results for nonlinear fractional differential equations by using fixed point theory on ordered Gauge spaces*, J. Adv. Math. Stud., **6**(2013), No. 2, 154-158.
[27] A. Ouahab: *Some results for fractional bundary value problem of differential inclusions*, Nonlinear Anal., **69**(2008), 3877-3896.
[28] I. Podlubny: *Fractional differential equations*, Academic Press, 1999.
[29] S.G. Samko, A.A. Kilbas and O.I. Marichev: *Fractional integrals and derivatives: theory and applications*, Gordon and Breach, Yverdon, 1993.

Islamic Azad University
Department of Mathematics, Bonab Branch
Bonab, Iran
E-mail address: mehdi.moghaddam49@gmail.com

Islamic Azad University
Department of Mathematics, Miandoab Branch
Miandoab, Iran
E-mail address: hakimeh.mohammadi@yahoo.com