

EXISTENCE AND UNIQUENESS OF MILD SOLUTIONS TO NEUTRAL IMPULSIVE FRACTIONAL STOCHASTIC DELAY DIFFERENTIAL EQUATIONS DRIVEN BY BOTH BROWNIAN MOTION AND FRACTIONAL BROWNIAN MOTION

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Abstract. In this paper, we discuss the existence and uniqueness of a mild solution for neutral impulsive fractional stochastic delay differential equations driven by Brownian motion, and fractional Brownian motion with the Hurst parameter $H \in (1/2, 1)$, by using Banach fixed point theorem in a Hilbert space.

Mathematics subject classification (2020): 60G22, 45N05, 34G20, 60H15, 60G15, 35R12.

Keywords and phrases: Fractional calculus, mild solution, semigroup of bounded linear operator, fractional Brownian motion, stochastic differential equation with time delay, Young integral, Wiener integral.

REFERENCES

- [1] R. HILFER, *Application of fractional calculus in physics*, New Jersey: World Scientific, (2001).
- [2] J. SABATIER, O. P. AGRAWAL, J. A. T. MACHADO, *Advances in fractional calculus*, Dordrecht, The Netherlands: Springer, (2007).
- [3] N. A. KHAN, A. ARA, A. MAHMOOD, *Approximate solution of time-fractional chemical engineering equations: a comparative study*, Int. J. Chem. Reactor Eng., 8 (2010) Article A19.
- [4] K. B. OLDHAM, *Fractional differential equations in electrochemistry*, Adv. Eng. Softw., 41 (1) (2010), 9–12.
- [5] J. H. HE, *Some applications of nonlinear fractional differential equations and their approximations*, Bull. Sci. Technol., 15 (2) (1999), 86–90.
- [6] J. CAO, Q. YANG, Z. HUANG, Q. LIU, *Asymptotically almost periodic solutions of stochastic functional differential equations*, Appl. Math. Comput. 218 (2011) 1499–1511.
- [7] J. CAO, Q. YANG, Z. HUANG, *On almost periodic mild solutions for stochastic functional differential equations*, Nonlinear Anal. TMA 13 (2012), 275–286.
- [8] P. BALASUBRAMANIAM, P. TAMILALAGAN, *The Solvability and Optimal Controls for Impulsive Fractional Stochastic Integro-Differential Equations via Resolvent Operators*, J Optim Theory Appl (2017) (174), 139–155.
- [9] P. BALASUBRAMANIAM, N. KUMARESAN, K. RATNAVELU, P. TAMILALAGAN, *Local and Global Existence of Mild Solution for Impulsive Fractional Stochastic Differential Equations*, Bull. Malays. Math. Sci. Soc. (2015) (38), 867–884.
- [10] X. MAO, *Stochastic Differential Equations and their Applications*, Horwood Publishing, Chichester, (1997).
- [11] G. DA PRATO AND J. ZABCZYK, *Stochastic Equations in Infinite Dimensions*, Cambridge University Press, Cambridge (1992).
- [12] FRANCESCA BIAGINI, YAOZHONG HU, BERNT OKSENDAL AND TUSHENG ZHANG, *Stochastic Calculus for Fractional Brownian Motion and Applications*, Springer-Verlag London, (2008).
- [13] X. MAO, *Exponential stability in mean square of neutral stochastic differential functional equations*, Systems Control Letters, (1995) 0167–6911.

- [14] DEZHI LIU, GUIYUAN YANG AND WEI ZHANG, *The stability of neutral stochastic delay differential equations with Poisson jumps by fixed points*, Journal of Computational and Applied Mathematics, 235, (2011) 3115–3120.
- [15] M. FERRANTE AND C. ROVIRA, *Stochastic delay differential equations driven by fractional Brownian motion with Hurst parameter $H > 1/2$* , Bernoulli, 12 (2006), 85–100.
- [16] A. NEUENKIRCH, I. NOURDIN AND S. TINDEL, *Delay Equations driven by Rough Paths*, Elec. J. Probab., (13) (2008), 2031–2068.
- [17] T. CARABALLO, M. J. GARRIDO-ATIENZA, AND T. TANIGUCHI, *The Existence and Exponential Behavior of Solutions to Stochastic delay Evolution Equations with a Fractional Brownian Motion*, Nonlinear Analysis 74, (2011), 3671–3684.
- [18] MIN YANG AND HAIBO GU, *Riemann-Liouville fractional stochastic evolution equations driven by both Wiener process and fractional Brownian motion*, Journal of Inequalities and Applications, no. (8), (2021).
- [19] ANATOLY A. KILBAS, HARI M. SRIVASTAVA, JUAN J. TRUJILLO, *Theory and Applications of Fractional Differential Equations*, Elsevier, (2006).
- [20] D. NUALART, *The Malliavin Calculus and Related Topics*, second edition, Springer-Verlag, Berlin, (2006).
- [21] K. BANUPRIYA, S. ABINAYA, *Neutral Impulsive Stochastic Differential Equation Driven By Fractional Brawnian Motion With Finite Delay and Poisson Jumps*, Journal of Fractional Calculus and Applications, vol. 11 (1) Jan. (2020), 11–21.
- [22] JINRONG WANG, MICHAL FEČKAN AND YONG ZHOU, *On the new concept of solutions and existence results for impulsive fractional evolution equations*, Dynamics of PDE, vol. (8), no. (4), (2011), 345–361.
- [23] Y. ZHOU, F. JIAO, *Existence of mild solutions for fractional neutral evolution equations*, Comput. Math. Appl. 59 (3), (2010), 1063–1077.