

## ON THE CAUCHY PROBLEM OF A DELAY STOCHASTIC DIFFERENTIAL EQUATION OF ARBITRARY (FRACTIONAL) ORDERS

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**Abstract.** In this work, we are concerned with the Cauchy problem of a delay stochastic differential equation of arbitrary (fractional) orders. The existence (local) of a unique mean square continuous solution is proved. The continuous dependence of the solution on the initial random variable is studied.

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### REFERENCES

- [1] Y. CHEN AND K. L. MOORE, *Analytical stability Bound for a class of Delayed Fractional Order Dynamic Systems*, Nonlinear Dynam. **29** (002), 199–200.
- [2] R. F. CURTAIN AND A. J. PRITCHARD, *Functional analysis in modern applied mathematics*, Academic Press, 1977.
- [3] M. M. EL-BORAI, K. E. EL-NADI AND H. A. FOUAD, *On some fractional stochastic delay differential equations*, Comut. Math. Appl., **59** (3), (2010), 1165–1170.
- [4] A. M. A. EL-SAYED, *On the stochastic fractional calculus operators*, Journal of Fractional Calculus and Applications, **6** (1), (2015), 101–109.
- [5] A. M. A. EL-SAYED, M. A. EL-TAWIL, M. S. M. SAIF AND F. M. HAFEZ, *The mean square Riemann-Liouville stochastic fractional derivative and stochastic fractional order differential equation*, Math. Sci. Res., j. **9**, no. 6 (2005), 142–150.
- [6] F. M. HAFEZ, A. M. A. EL-SAYED AND M. A. EL-TAWIL, *On a stochastic fractional calculus*, Fractional Calculus and Applied Analysis, **4**, no. 1 (2001), 81–90.
- [7] F. M. HAFEZ, *The Fractional calculus for some stochastic processes*, Stochastic Analysis and Applications, **22**, no. 2 (2004), 507–523.
- [8] T. T. SOONG, *Random Differential Equations in Science and Engineering*, Academic Press, New York (1973).
- [9] Z. WANG, *A Numerical Method for delay Fractional-Order Differential Equations*, J. Appl. Math. Vol. **2013** (2013).
- [10] E. WONG, *Stochastic Processes, Informations and Dynamical Systems*, McGraw-Hill, New York (1971).
- [11] E. WONG, *Introduction to Random Processes*, Springer-Verlag, Berlin (1980).