Dynamics of Continuous, Discrete and Impulsive Systems
Series **A:** *Mathematical Analysis* **26 (2019)** 373-387
 http://www.watam.org

MEAN SQUARE MITTAG-LEFFLER STABILITY OF FRACTIONAL ORDER STOCHASTIC SYSTEM WITH TIME DELAY†

Qian Zhang[4,1], Yi Zhang[1], Hongting Shi[2],
Xiaosheng Zhang[2], Qinnan Li[1], Fang Wang[3]

[1]College of Arts and Sciences, Department of Mathematics
China University of Petroleum-Beijing at Karamay, 834000, China

[2]School of Mathematical Sciences
Capital Normal University, Beijing, 100048, China

[3]Beijing Chen Jinglun High School, Beijing, 100020, China

[4]Department of Arts and Sciences,
Chengdu College of University of Electronic Science and
Technology of China, 611731, China

Abstract. In this paper, we investigate the mean square Mittag-Leffler stability of fractional order stochastic system with time delay. Firstly, definitions of mean square Mittag-Leffler stability of fractional order stochastic system is given. Then, using the methods of Lyapunov function, the Laplace transform technique and stochastic analysis theory, some sufficient conditions are derived, which guarantee the mean square Mittag-Leffler stability of fractional order stochastic system with time delay. Finally, an example is given to illustrate the results.

Key words: fractional order stochastic system, mean square Mittag-Leffler stability, time delay .

1 Introduction

Fractional calculus is regarded as a generalization of the classical integer-order calculus to arbitrary order which has become very popular. In particular, fractional order differential equations have been applied in various fields of science such as engineering, physics and chemistry [1]-[3]. Compared with the integer-order models, fractional order differential equations provide an excellent tool for the description of memory and hereditary properties of various materials and processes [4]-[6]. In recent years, there are many researches on fractional order differential equations. The book of V.Lakshmikantham, S.Leela and J.Vasundhara Devi [7] played an important role by providing a systematic account of recent developments, describing the current state of the useful theory, showing the essential unity achieved and initiate several new extensions to other types of fractional dynamic systems. Domenico Delbosco and Luigi Rodino [8] studied existence and uniqueness for nonlinear fractional

†Corresponding author: Yi Zhang