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Faedo-Galerkin approximate solutions of neutral stochastic fractional differential equation with finite delay

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Abstract

In this work, we study a class of neutral stochastic fractional differential equation in an arbitrary separable Hilbert space H. We obtain an associated integral equation and then consider a sequence of approximate integral equations obtained by projection of considered associated integral equation onto finite dimensional space. The existence and uniqueness of solutions to every approximate integral equation are obtained by using Banach fixed point theorems and analytic semigroup theory. We show the convergence of the solutions by using Faedo-Galerkin approximations and give an example to show the effectiveness of the main theory. Finally, we provide the conclusion at the end.

Keywords: Analytic semigroup, Banach fixed point theorem, Caputo derivative, Faedo-Galerkin approximation, Stochastic differential equation.

2010 Mathematics Subject Classification: 26A33, 34K37, 34K40, 34K45, 35R60, 45J05, 46C15, 60H15, 60H20.

1 Introduction

During the few years, the fractional calculus, which permits for us to study differentiation and integration of any order, has received a lot of consideration from many researchers and scientists due to its incredible applications in various fields such as material sciences, mechanics, seepage flow in porous media, in fluid dynamic traffic models, population dynamics, economics, chemical technology, medicine and many others. The fractional differential equations are found to be more suitable than classical differential equations for describing the some real world problems and phenomena which arise in engineering and science, such as physics, biology, viscoelasticity, electrochemistry, electromagnetic, control. Indeed, the memory and genetic properties of different materials and process can be described by the differential equation involving fractional derivative. The

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