DOI 10.1007/s10559-024-00687-2
Cybernetics and Systems Analysis, Vol. 60, No. 3, May, 2024

ON THE EXISTENCE OF THE OPTIMAL CONTROL FOR STOCHASTIC FUNCTIONAL DIFFERENTIAL EQUATIONS SUBJECT TO EXTERNAL DISTURBANCES

V. K. Yasynskyy[1†] and I. V. Yurchenko[1‡]

UDC 519.21

Abstract. *The authors discuss the comparison theorem for solutions of stochastic functional differential equations subject to external disturbances and its application to a stochastic control problem.*

Keywords: *comparison theorem, stochastic control, stochastic functional differential equations.*

To the Memory of Mykhailo Leonovych Sverdan
(01.18.1940–11.19.2023)

INTRODUCTION

Within the framework of stochastic control theory, control in systems with random parameters is investigated. This theory is widely applied in many fields, including finance, engineering, economics, etc.

The beginning of stochastic control theory is associated with the analysis of solutions to stochastic differential equations describing system's evolution in time under random disturbances or influence of random factors. Stochastic control theory was developed by improving the methods of solving stochastic differential equations, introducing new approaches to the analysis of random processes, and applying them to such areas as finance, optimal portfolio management, risk management, and many others (see [1–11]).

Modern research in stochastic control theory continues to expand its application to new fields, develop more efficient methods for solving complex problems, and expand its theoretical base.

This article considers the comparison theorem for solutions of stochastic functional differential equations (SFDE) subject to external disturbances and its application to a stochastic control problem, which is a development of the results obtained for one-dimensional Ito processes in [3, 5–7] and for the case of Poisson disturbances in [12–15].

COMPARISON THEOREM FOR SFDE SOLUTIONS

Let (Ω, F, P) be a probability space with a flow of σ-algebras $\{F_t, t \geq 0\}$, $\mathbf{D}$ be the space of right-continuous functions with left-hand boundaries (RCLB) with values from $\mathbf{R}^1$ and with a uniform metric [1–3].

THEOREM 1. Let the following be given:

(i) a strictly increasing function $\{\rho(x), x \in \mathbf{R}_+\}$ such that

$$\rho(0) = 0, \ \int_0^\infty \rho^{-2}(x) dx = \infty;$$

[1]Yuriy Fedkovych Chernivtsi National University, Chernivtsi, Ukraine, [†]*v.yasynskyy@chnu.edu.ua*; [‡]*i.yurchenko@chnu.edu.ua*. Translated from Kibernetyka ta Systemnyi Analiz, No. 3, May–June, 2024, pp. 141–151; DOI 10.34229/KCA2522-9664.24.3.13. Original article submitted January 30, 2024.