DOI 10.1007/s10559-020-00246-5
Cybernetics and Systems Analysis, Vol. 56 No. 2, March, 2020

NECESSARY AND SUFFICIENT CONDITIONS OF STABILITY IN THE QUADRATIC MEAN OF LINEAR STOCHASTIC PARTIAL DIFFERENTIAL-DIFFERENCE EQUATIONS SUBJECT TO EXTERNAL PERTURBATIONS OF THE TYPE OF RANDOM VARIABLES

T. O. Lukashiv,[1†] **I. V. Yurchenko,**[1‡] **and V. K. Yasynskyy**[1††]

UDC 519.217

Abstract. *We obtain the necessary and sufficient conditions for the stability in the quadratic mean of strong solutions to stochastic partial differential-difference equations with pairwise independent external random perturbations of the type of random variables.*

Keywords: *stochastic partial differential equation, stability in the quadratic mean, random perturbation.*

In cherished memory of our teacher Evgenii Fedorovich Tsarkov, 12.08.1935–10.30.2018

INTRODUCTION

After the concepts of stochastic differential and integral, replacement of variables for a stochastic differential, determination of a strong solution of a stochastic differential equation have been introduced and then expanded to the classes of stochastic functional differential equations (see, for example, [1–5]), it became possible to analyze asymptotically strong solution for stochastic partial differential equations.

In [6], conditions are obtained for the existence of a strong solution of the Cauchy problem for stochastic partial differential-difference equations (SPDDE) with given external random perturbations of pairwise independent random quantities, which are independent of Wiener processes that appear in the definition of Ito stochastic diffusion equations. Similar problems are considered in [7].

In the present paper, we will obtain the necessary and sufficient conditions of stability in the quadratic mean of strong solutions to SPDDE with pairwise independent random external perturbations of the type of random variables.

PROBLEM STATEMENT

Let a random function $u(t, x, \omega)\colon [0, \infty)\times \mathbf{R}^1 \times \Omega \to \mathbf{R}^1$ be defined on probability basis $(\Omega, \mathcal{F},\ \mathbf{F} = \{\mathcal{F}_t,\ t \ge 0\}, P)$. With probability one, the function is measurable in t and x with respect to the minimum σ-algebra $\mathcal{B}([0, T], \mathbf{R}^1)$ of Borel sets on the plane.

[1]Yuriy Fedkovych Chernivtsi National University, Chernivtsi, Ukraine, [†]*t.lukashiv@gmail.com*; [‡]*i.yurchenko@chnu.edu.ua*; [††]*v.yasynskyy@chnu.edu.ua*. Translated from Kibernetika i Sistemnyi Analiz, No. 2, March–April, 2020, pp. 157–165. Original article submitted February 7, 2019.