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ON THE SEMI-MARKOVIAN RANDOM WALK WITH DELAY AND WEIBULL DISTRIBUTED INTERFERENCE OF CHANCE

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Abstract

In this paper, a semi-Markovian random walk with delay and a discrete interference of chance $(X(t))$ is considered. It is assumed that the random variables $\{\zeta_n\}$, $n \geq 1$ which describe the discrete interference of chance have Weibull distribution with parameters (α, λ), $\alpha > 1$, $\lambda > 0$. Under this assumption, the ergodicity of this process is discussed and the asymptotic expansions with three terms for the first four moments of the ergodic distribution of the process $X(t)$ are derived, when $\lambda \to 0$. Moreover, the asymptotic expansions for the skewness and kurtosis of the ergodic distribution of the process $X(t)$ are established.

Keywords: Semi-Markovian random walk; a discrete interference of chance; Weibull distribution; ergodic distribution; asymptotic expansion; ladder variables.

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1. Introduction

Many applied problems of the queueing, reliability, inventory control, insurance and other theories are formulated in the terms of random walks with various types of barrier. Some important studies on this topic exist in the literature (see, for example, [1–9]). Let us consider the following model before stating the problem mathematically.

The Model. Suppose that, the system is in state $z = s + x$ at the initial time $t = 0$. Here, $s > 0$ is a predefined control level, and $x > 0$. Demands and supplies are occurred at the random times $T_n = \sum_{i=1}^{n} \xi_i$, $n \geq 1$. System passes from a state to another one by jumping at time T_n, according to quantities of demands and supplies $\{\eta_n\}$, $n \geq 1$. This change of system continues until certain random time τ_1, where τ_1 is the first passage time

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