Asymptotic Analysis of Multi-thread Heterogeneous Queuing System under Conditions of Extremely Rare Changes in the States of the Markov Chain Controlling Input Flows

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The paper examines a multi-threaded queuing system where flow intensity changes according to the states of a Markov random environment. Incoming requests from various flows are serviced during an exponentially distributed random time with parameters set by the type of flow. The random environment does not influence service. This study is conducted under conditions of extremely rare changes in environmental conditions. The form of the multi-dimensional asymptotic characteristic function is established. It is proved that one-dimensional (marginal) stationary probability distributions of the number of engaged devices of each type are weighted sums of Poisson distributions. A numerical analysis was performed to determine the range of applicability of the established approximation.