Kudryavtsev E. V., Mikhaleva A. E. (Lobachevsky State University of Nizhny Novgorod, Nizhny Novgorod, Russia). **Analysis of a Queueing System with a Loop and Queue Thresholds.**

We consider a queueing system with two conflicting non-ordinary input flows Π_1 and Π_2 with intensities of batch arrival epochs λ_1 and λ_2 and mean batch sizes m_1 and m_2. The system is examined at discrete random instants τ_i coinciding with the moments of state changes Γ_i of the server. The random element $\Gamma_i \in \Gamma = \{\Gamma^{(1)}, \Gamma^{(2)}, \Gamma^{(3)}, \Gamma^{(4)}\}$ and the queue lengths $\varkappa_{1,i}, \varkappa_{2,i}$ for flows Π_1 and Π_2 determine the system state at time τ_i. The mathematical model of the system is described by a Markov chain $\{(\Gamma_i, \varkappa_{1,i}, \varkappa_{2,i}); i = 0, 1, \ldots\}$. The server switches between states according to a non-cyclic algorithm with a cycle (loop):

$$\Gamma_{i+1} = \begin{cases} \Gamma^{(1)}, & \Gamma_i = \Gamma^{(4)} \text{ or } \Gamma_i = \Gamma^{(1)}, \varkappa_{1,i} > h_1, \varkappa_{2,i} < h_2; \\ \Gamma^{(2)}, & \Gamma_i = \Gamma^{(1)}, \varkappa_{1,i} \leq h_1 \text{ or } \varkappa_{2,i} \geq h_2; \\ \Gamma^{(r+1)}, & \Gamma_i = \Gamma^{(r)}, r \in \{2, 3\}; \end{cases}$$

where h_1 and h_2 are the threshold values of queue lengths for flows Π_1 and Π_2. The durations of states Γ_i are fixed and equal to T_i, $i = 1, 2, 3, 4$. In states Γ_1 and Γ_3, customers of flows Π_1 and Π_2 are served. The maximum possible number of customers served in these states is given by constants a_1 and a_2.

Theorem. A necessary condition for the limiting distribution existence for the Markov chain $\{(\Gamma_i, \varkappa_{1,i}, \varkappa_{2,i}); i = 0, 1, \ldots\}$ is the inequalities

$$\alpha a_1 > \lambda_1 m_1 (\alpha T_1 + T_2 + T_3 + T_4),$$
$$a_2 > \lambda_2 m_2 (\alpha T_1 + T_2 + T_3 + T_4),$$

where α is the expected number of consecutive entries into state Γ_1.