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A MODEL TO CONTROL A QUEUE IN A VOICE SELF-SERVICE PORTAL WITH FAST AND SLOW SERVERS

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In this paper, we consider mathematical models for analysis and optimization of call centers of modern architecture having a self-service facility on the base of computer speech recognition. In such centers, service is provided by both operators and self-service ports. It is shown that the optimal policy for queue control improves service characteristics.

1. Introduction

Improvement of characteristics of service is an actual problem for the call centers. In [1-3], the models applied to the description of functioning of the call service centers on the basis of the "classical" queueing system theory are investigated. Models in [3-8] deal with the factors such as multi-class calls, various service disciplines, "patience" of a user, repeated calls.

However the contact processing centers of the modern architecture with voice self-service systems based on speech technologies are not investigated. Such centers allow to providing the full service of the majority of incoming calls in automatic mode, without participation of the operators. An example of the call center processing with self-service systems on the basis of speech technologies is the system "Automatic dispatcher" for a taxi service, system "Autosecretary" for scheduling the calls, etc. [9-12]. Customer calls arrive in the call processing centre from different type networks: a public switched telephone network, networks of mobile communication operators, the Internet. The call centre includes ports of self-service on the basis of computer speech recognition and an operator group. The calls are directed by different algorithms. One of the widely-used algorithms implies that incoming calls go the self-service ports first if one of them is idle, and to an operator group, otherwise. The calls which are not served because of the recognition errors of self-service ports are directed to an operator group.

2. Model of the call centre with self-service facility with the limited queue

The call centres with self-service facility can be investigated by means of an open exponential multi-server queueing network with two nodes, node 1 for self-service facility and node 2 for a group of operators. The node i represents a multi-server queueing system with n_i identical servers, $i = 1, 2$. Let the waiting space be limited for node 1 and unlimited for node 2 [14].

The process of call arrival is the Poisson with parameter λ. The calls are directed to node 1 or 2 depending on the number of idle servers in node 2.

If there are idle servers in node 2, the arriving calls are directed to node 2, otherwise they are directed to node 1. If one of busy servers in node 2 becomes idle and there are no waiting calls in the node, a call in the head of the queue in node 1 (if the queue is not empty), goes to node 2 and occupies the idle server. The call service time in node i is exponentially distributed with parameter μ_i.

Also, we assume that in the first node, a call is served successfully with probability $1-p$, and leaves the network upon its service completion. Otherwise, with probability p, the service is unsuccessful (the call processing failed, and the call should be reprocessed by an operator), and the call goes to the second node (see Fig. 1).