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Modelling of Telecommunication Transmission Network with Fiber Optic Channel

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In modern computer transmission networks the information is transferred by non-cable and cable communication channels, the latter are divided into three fundamental classes: cables on the basis of twisted pairs, coaxial cables and fiber optic communication channels.

The fiber optic channels are unidirectional, therefore the full connectivity of a network can be achieved with the help of double bus topology [1]. The principle of the "double bus" is realized through two communication channels, one of them transmits the information in one direction, and the other transmits it backward. In this case subscriber servers (SS) located closer to the main station have essential advantage in access to a communication channel in comparison with other servers. To eliminate this disadvantage one should develop such protocols of access, which use more fair strategies [2].

In this research we study the fiber optic transmission network with double bus topology. To analyze the transmission network we have constructed the mathematical bus request models as a of priority queuing system (QS) [3] with N Bernoulli incoming torrents in discrete time and a data bus as a cyclic service system. The course-of-value function of the probability distribution of the number of messages on an SS has been found

$$G(x) = \frac{1-a-\lambda}{\lambda} \cdot \frac{(\lambda x+1-\lambda)\left[1-(\lambda x+1-\lambda)F(\lambda x+1-\lambda)\right]}{(\lambda x+1-\lambda)F(\lambda x+1-\lambda)-x}.$$

Where a - total intensity of priority demand, and λ - demand intensity of the SS. The kind of the function $F(x)$ is determined by solving the task.

The decomposition technique was used while studying a cyclic system of queuing. The course-of-value function of the stationary probability distribution of the number of demands in the queuing system has been found.

$$\Phi(x) = \left[1-\lambda_k\left[1+\sum_{j\neq k} r_j\right]\right] \cdot \frac{(1-x)\,C_k(\Lambda_k(x))}{C_k(\Lambda_k(x))-x}.$$

Where $C_k(z)$ – course-of-value function of the holding time, $\Lambda_k(x)$ – dataflow parameter, r_k – the probability that the QS has got at least one application, λ_k – average number of demands on the server for a one hour period.

In this research characteristics of the probability and of time have been found, imitation system of simulation analysis in order to define the field of the results, application was obtained through the decomposition model research.

The above-cited approach can also be used in the research of double bus transmission network to compare with other protocols, particularly with DQDB protocol. The data obtained allow us to do statistical analysis of this network.

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