

LABORATORY 5

Laboratory of Teletraffic Theory

Head of Laboratory – Dr.Sc. (Technology) **Sergey Stepanov**

Tel.: (095) 299-94-15; E-mail: stepanov@iitp.ru

The leading researchers of the laboratory include:

Dr.Sc. (Techn.)	A. Kharkevich	Dr.Sc. (Techn.)	V. Ershov
Dr.Sc. (Math.)	I. Tsitovich	Dr.	V. Naumov
Dr.Sc. (Techn.)	V. Ivnitski		

DIRECTIONS OF ACTIVITY

The laboratory deals with the development of teletraffic theory and its applications in telecommunications and computer systems. The following problem areas and models are studied at the laboratory in 2003:

- the construction of numerically optimized algorithms of calculation the performance measures of queueing models described by multi-dimensional Markovian processes;
- the development and analysis of teletraffic models for performance evaluation of new cost-effective telecommunication systems;
- the development of the software tools based on the efficient algorithms to support the performance modelling of the teletraffic models;
- the construction of the asymptotically optimal procedures for the sequential design of experiments for statistical problems related to telecommunication networks;
- the analysis of switching systems and interconnection networks for telecommunication and multiprocessing systems.

MAIN RESULTS

Analytical model of multiservice network with differentiated service is derived. The directions of moving for priority real time traffic are described by route matrix. The corresponding calls are served on the base of model with losses. The direction and possibility of moving for packets are described by probability transition matrix. The corresponding calls are served on the base of model with waiting with unlimited buffer associated with each node of the network. The model designed has as particular cases all known before models with differentiated service. Exact and approximate algorithms are derived for estimation of the main performance measures of the model considered. (S. N. Stepanov, E. O. Naumova, E. I. Melik-Gaikazova)

Two-part model of telecommunication network was built. It includes subscriber access part and part of concentration. The preliminary analysis of the model was done in particular the area pf model usage is investigated. (A. D. Kharkevich, E. I. Melik-Gaikazova)

The robust asymptotically optimal methods of the second order for processing of traffic measurements data for telecommunication networks are derived. (I. I. Tsitovich)

Methods of diagnostics of two-link interconnection switchings for closing and opening of commutation elements are described. Two modes of determination of faults are discussed - using two or a single diagnostic buses. (V. A. Garmash)

The computer program package allowing to make synthesis for very wide class of the electrical filters has been developed. It permits also to analyze the characteristics of the filter synthesized. The package description has been published. It can help an engineer to formulate the specification for frequency filter design and to produce its synthesis, too. The theory and design of the analog and digital filters are discussed together at unified attitude. The examples for synthesis of the analog and digital filters and analysis of their frequency responses are illustrated, too. (A. A. Vitkova)

A problem of grade of service (GoS) probability characteristics and traffic parameters evaluation for ATM-node with direct (the first choice link) and one alternate (the second choice link) routes was investigated. It was assumed that the traffic was generated by finite number of multiservice traffic sources. A method to determine grade of service for different classes users using the alternate route was developed. Unlike the previous investigations in this area the problem for multiservice network was considered as multiple-valued one. In this case all procedures of the method dealt with vector variables. In particular the method allows to determine vectors of overflow traffic parameters offered to alternate route and to calculate vector of result loss probabilities for different classes users with using four variants of reservation and GoS equalization on direct and alternate routes. (V. A. Ershov, O. F. Sergeeva)

The Markov queueing networks with parameters depending on their states and the Markov queueing networks with different classes of customers were investigated. It was essentially used known condition Kovalenko that was generalized in necessary degree. For above-mentioned Markov queueing networks the analytic decisions for stationary state probabilities were obtained. The necessary and sufficient conditions for their expression in analytic form were obtained. (V. A. Ivnitski)

The theorem about analytical form of stationary state distribution non-product form for Markov queueing networks with the same type customers was proved. Some partial cases for two- and three-nodes networks with non-product form were considered. (O. V. Ivnitski)

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- **Russian Foundation of Basic Research (№ 01-01-00287):** "Non-parametric hypotheses testing with guaranteed decision rule and its applications" (head I. I. Tsitovich).

PUBLICATIONS IN 2003

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