COMPUTER-CONTROLLED PORTABLE OPTICAL COMMUNICATION SYSTEMS

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The development of science and technology requires lossless and accurate transmission of information in many fields. The type of communication used for data transmission is determined based on the volume of the transmitted data, the frequency band it occupies, the requirement for its reproduction accuracy, transmission distance and other characteristics. In a number of cases, high requirements are placed on the confidentiality of the transmitted information. The fulfillment of these requirements can be ensured with the help of various cryptographic methods and (or) the application of technical ways that ensure that the information reaches only the required user.

Technologies that create high-speed communication channels with means of radiation operating in the optical range are the basis of wireless optical communication systems. These technologies make it possible to transmit data (text, voice, graphics, etc.) between objects through the air without using optical fiber cables [1-6]. At the tactical level, the timely and secure delivery of large volumes of information in various types of combat is a criterion for the successful outcome of planned operations.

The investigated portable optical communication system belongs to a complex of technical tools that includes all the factors mentioned above [7-8].Thus, a semiconductor laser with sufficiently high coherence is used in a portable atmospheric optical communication system. This, in turn, ensures high spatial selectivity, where transmitted data stream is delivered only to the receiver. As a result, the system ensures a high degree of security of confidential information transmission over such short distances (5-10 km). In addition, the application of acousto-optic means, mainly an acousto-optic modulator, plays a major role in increasing the resistance and effectiveness of the system [9].

In the article, the possibility of building a computer-controlled portable optical communication system is experimentally confirmed. A number of results of experimental studies are presented in the form of tables and pictures. These results clearly confirm the effectiveness of the proposed construction. The principle of constructing an portable optical communication systems is analyzed, in which signal fields are formed by a system of semitransparent and opaque mirrors, and the signal delay is controlled by changing the frequency of a voltage-controlled generator. The controlled delay of signals is one of frequently used functional operations in systems for formation and processing of the information. It is applied, for example, in radar systems .

The purpose of the present work is the synthesizing of computer-controlled portable optical communication systems with short time for an establishment of a necessary delay of signals.

We can decrease step of the delay time adjustment by increasing of the number of the light beams. The same experiment can be provided by using a range of the laser diodes. The computer-controlled portable optical communication systems with small size can be done by optimizing of the design of the individual nodes.

ANALYSIS OF RELIABILITY INDICATORS HARDWARE AND SOFTWARE COMPLEXES SPECIAL PURPOSE COMMUNICATION NETWORKS

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Ensuring the technical reliability of hardware and software systems in complex military communication infrastructures remains a key research area in the field of secure telecommunication networks.

One of the critical issues in this domain is the formulation of a systematic methodology to assess essential reliability parameters—including failure-free operation, durability, maintainability, and storability — as well as the derivation of a generalized composite reliability indicator that reflects the overall security and operational efficiency of the system.

In particular, the problem is compounded by the inherent uncertainty and noise in the initial input data, which is characteristic of real-world telecommunication environments such as public communication networks, mobile wireless systems, and fiber-optic infrastructures. Conventional approaches often rely on threshold-based integration of individual parameters, yet these methods face limitations in handling high-dimensional probabilistic distributions and noisy observations.

This study presents an advanced methodology based on vector reliability modeling and statistical noise-filtering techniques.

A key contribution is the development of a reliability vector that captures the deviation of actual system performance from required norms across time and operational stages. Special attention is given to maintainability analysis, where statistical deviations in parameters such as mean time to restore, restoration coefficient, restoration intensity, and repair labor intensity are systematically quantified. These are represented as sub-components of the overall reliability model.

Furthermore, the paper introduces the use of multi-dimensional joint probability distribution densities to model the reliability state space over time. However, the associated computational burden due to the so-called “curse of dimensionality” is addressed through a two-stage optimization and filtering procedure.