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Improving Equipment Reliability and System Maintenance and Repair Efficiency

A.Yu. Rusin [a*], Ya.V. Baryshev [a]

[a] *Tver State Technical University, Department of Power Supply and Electrical Engineering, Naberezhnaya Afanasiya Nikitina, 22, Tver, Tver region, 170026, Russia.*

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Abstract

Mean time to failure of modern machinery and equipment, their individual parts and components can be calculated over the years. Methods for determining the optimal frequency of maintenance and repair, based on the collection and processing of information about the reliability of industrial facilities, during their testing in laboratories and at special sites, as well as through long, operational tests require considerable time and become expensive. The purpose of this work is to develop methods for processing information about the reliability of equipment in automated systems for maintenance and repair, which will reduce the time to collect information on equipment failures and improve the cost-effectiveness of maintenance and repair. Small, multiple-censored right-side samples of equipment operating time for failure are formed as a result of failure data collection in an automated system for equipment maintenance and repair. Calculation of reliability indicators for such samples is performed using the maximum likelihood estimation method. The article presents experimental studies of the accuracy of the maximum likelihood estimates of the parameter of the exponential distribution law for small, multiple right-censored samples. The studies were carried out by computer modeling of censored samples, similar to samples that are formed when monitoring equipment during operation. Methods of simulation modeling of random processes on a computer and methods of regression analysis were used. Analysis show that most of the maximum likelihood estimates obtained from small, multiple-censored right-side samples have significant deviations from the true values. A technique for improving the accuracy of maximum likelihood estimates is proposed. The scientific novelty is regression models are constructed that establish the relationship between the deviation of the maximum likelihood estimate from the true value and the parameters characterizing the sample structure. These models calculate and introduce corrections to maximum likelihood estimates. The use of the developed regression models will reduce the time to collect information about the reliability of the equipment, while maintaining the reliability of the results.

Keywords: System Maintenance and Repair; Equipment Reliability; Censored Samples; Maximum Likelihood Method; Computer Simulation.

1. Introduction

The essence of the system maintenance and repair lies in the fact that after a certain amount of time worked, various types of repair work are carried out aimed at restoring the equipment (maintenance, current or capital repairs). The system of maintenance and repair is a regulatory information base necessary for the development and scheduling of maintenance and repair. It contains the scope of work for maintenance, current or capital repairs; structure and frequency of maintenance and repair; norms of labor intensity and repair time; consumption rates of basic materials, components, spare parts; reserve standards. Regulatory and information base is formed on the basis of industry average indicators. As

* Corresponding author: alex.rusin.tver@gmail.com

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