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Ensuring quality and safety in a cost constrained environment: which trade-off? (1)

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ADEQUATE SELECTION OF TESTS SCHEMES AND DISTRIBUTION LAWS OF RANDOM VARIABLES ARE THE BASIC PRECONDITIONS FOR PROVIDING THE SPACE SYSTEMS RELIABILITY

Abstract

If the result of probability estimation is not recognized convincing, physicists say that mathematicians offered inadequate model. And mathematicians assert that tests have been executed incorrectly. These statements have the objective reasons if the condition, stated in heading, has not been satisfied. We consider a preparing of a space system to functioning as random process in a simple Poisson's flow, where the probability P of casual event is defined in independent tests by Bernoulli's scheme. In each experiment an event A-success occurred (PA = p), or opposite event B- failure did not occurred (PB = q = 1 – p). In case of success, a detail is considered suitable, in case of failure – detail should be rejected. For analyses of space systems we are using the Geometric distribution of random variable X, which equals to number of experiences in the tests, run before first "success", with probability p of occurrence in one experience and not occurrence q = 1-p. Examples: number of shots before first hit, number of tests before failure, etc. Having a number X = 1, 2, 3,. . . , we define pm = P (X = m) = q m-1 x p, and obtain the geometric progression p, q p, q2 p, . . . , q m-1 p,. . . So, we have received the distribution name. For continuous numbers, the exponential distribution serves as analogue of geometric distribution. We define the level of pm at the exponential curve; and we have accepted its value 0.98 as apriory reliability. Further, we have to provide the reliability a posterior using the final functional checks. It is homogeneous Markov's process which is generalization of the scheme of Bernoulli at dependent tests. Here the theorem of hypotheses and formula of total probability, are analytical base for evaluation Then we find conditional probability PA (H1) under the Bayes formula

After successful finishing checks we use the result of experts' estimation. Based on this, we change a priory reliability 0,98 to new value 0,998 and refusal value 0,002. Then we put the meanings to the formula.

The received estimation is near to the numerical indicators of the improbable event. And taking into account barriers of safety, which will neutralize risks, it provides acceptable level of system reliability.