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Insuring Quality and Safety in a Cost Constrained Environment: Which Trade-Off? (1)

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THE PRACTICAL CONFIDENCE PRINCIPLE AS THE CRITERION OF THE STABLE FUNCTIONING OF A SPACE SYSTEM

Abstract

The practical confidence principle cannot be proved by mathematical means; it is based on practical experience and industrial traditions. The decision of how small must be the probability to consider the event impossible, depends on the importance of experience's results has for us. However, when we perform quantified evaluation we use mathematical methods, and so, conditions of necessity and sufficiency are becoming most relevant for us. And in addition, we have to provide not only high reliability but also eliminate the possibility of individual risks. And so we begin to define the reliability a priori by the Bernoulli scheme, where the mathematical model is represented as a Poisson stream. Quantitative assessment of reliability is performed using an exponential distribution of random variables. As we see in the graph, the curve of the function asymptotically approaches to 1, and the gradient and the curvature are decreasing. For example, in the range where F(x) greater then 0.95-0.98, the difference between its values on the segment will be below the "significance value". Further increase of the number of experiments will give no significant growth of "expectation value". So, we give up repetitions and go to the next step. We perform final functional tests. Using results of these tests, and the theorem of hypotheses and the Baye's formula, we estimate the reliability a posterior of the system. In this case, the model of a random process is a homogeneous Markov chain. The experiments and evaluations give a positive result, but only with providing system technological support and its maintainability. All these permit us to achieve a high level of "immediate readiness". Further, the reliability is ensured by using the methods of Markov's decisions. A Markov process is easy illustrated by graphs of states. The terms "event" refers to the state of the system S, and the term "test" means the change of states s1, s2, . . . , i.e. the transitions between them. This scheme eliminates the uncertainty in ensuring of the systems sustainability , and clearly defines their functional positions: 1-acceptable reliability; or 2 - possible failure, but there is a chance, and so on. . .