

RELIABILITY ANALYSIS METHODS APPLICATION IN MANAGEMENT

ИСПОЛЬЗОВАНИЕ МЕТОДОВ АНАЛИЗА НАДЕЖНОСТИ В МЕНЕДЖМЕНТЕ

В статье описываются подходы к оценке показателей надежности структурно-сложных систем в менеджменте. Оцениваются возможности применения для решения таких задач систем с двумя состояниями (BSS) и систем со многими состояниями (MSS). Дана общая характеристика задач менеджмента, решение которых приводит к необходимости анализа структурно-сложной системы с использованием математического аппарата систем со многими состояниями.

In this time the reliability analysis is a complex, interdisciplinary field of science that allows examining different types of complex system. A technical and information system has been object for reliability investigation firstly. Effective methods for reliability analysis of these systems have been developed. Note that modern technology and information systems have high reliability. This level of reliability is caused by technological advances and by effective methods of reliability analysis too. However, the problem of rejection, failure or error of system is still relevant despite high reliability of most modern technical and information systems. Detail analyze of this problem is considered in papers [1]. One of possible decision in these papers is proposed new approach to interpretation of investigation system. As a result the concept of socio-technical system that includes hardware, software and human factors is introduced [1]. Such changes in interpretation of the initial object cause a number of theoretical assumptions and basic conception in reliability analysis [1]:

- Definition of the initial mathematical model and number of performance level for system presentation;
- Elaboration of methods for system reliability quantification;
- Development of methods for uncertainty analysis in system behavior.

Well known two mathematical models in reliability analysis: Binary-State System (BSS) and Multi-State System (MSS). The system and its components have only two possible states (completely failed and perfect functioning) in a BSS. Although, there are many systems, that can be better represent with more than two such states e.g. electricity or transport oil. MSS reliability analysis is a more flexible approach to evaluate system reliability that can be used when both the system and its components have more than two states, to include, completely failed, partially failed, partially functioning and perfect functioning. Reliability analysis of system needs mathematical interpretation and presentation of initial system. For such a complex system is necessary to use presentation based on MSS [1]. The developed methods of analysis MSS it's founded on representation in the form of the structure function, which is not allowed to investigate the dynamic behavior of the system. But now effective methods for solution of these problems have been proposed. The representation of the

structure function of MSS by Multiple-Valued Decision Diagram (MDD) can resolve the difficulties associated with large dimension, since the representation of the structure function in the form of MDD requires fewer resources than analytic. An analysis of publications shows that the development of this direction in investigation of MSS is currently quite promising.

There are many applications of MSS in real life. These include transportation systems, air systems, telecommunications networks, satellite systems, computer systems, power grid, mining systems and management. Consider some example management applications in more detail.

Application of the MSS in the urban infrastructure analysis is presented in [2]. The city infrastructure in the paper consists of 12 classes. Each main class can be divided into several subclasses. At the same time, each class may also feature the state that will present the current state of the component. An example of such segmentation is presented in the city roads category. Roads are classified on the roads, sidewalks, bridges and other access routes. Roads are divided into urban roads and industrial roads. Next, urban roads can be divided according to the coating (asphalt, paved) and by type of category (first category, second category). All urban infrastructure are subject to external influences and their condition is progressively by using worsens. So every infrastructure components has several states. Analysis infrastructure system helps to improve better redistribution of city finance for maintenance (e.g. roads). This will maintain a reasonable level of infrastructure quality and at the same time an adequate amount of maintenance costs.

Other MSS application about production management problem is presented in [3]. The factory has five productions lines of single product and four different levels of production. Levels are adapted from the maximum customers demand (state 4), by an average claim (state 3) until low customer demand (state 2). State 1 describes the situation, where the factories don't works. We can apply the multi-state k -out-of- n model on this entry. Using this model we can develop a probability distribution of factory production for individual type's products with various customers' demands.

Other examples MSS application in management inter alia helps to improve redistribution of finance and optimizing working processes. Therefore mathematical approach of MSS reliability analysis allow to estimate the system in economic. Detailed review of MSS reliability analysis methods application is in article "Multi-State System for reliability analysis in application problem" (E. Zaitseva, J. Kostolny, Digital Technologies, Zilina, Slovakia, 2011).

References

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