

## Logical-Probabilistic Modeling of the Reliability of Complex Systems

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**Abstract :** The paper presents logical-probabilistic methods, models, and algorithms for reliability assessment of complex systems, based on which a web application for structural analysis and reliability assessment of systems was created. It is important to design systems based on structural analysis, research, and evaluation of efficiency indicators. One of the important efficiency criteria is the reliability of the system, which depends on the components of the structure. Quantifying the reliability of large-scale systems is a computationally complex process, and it is advisable to perform it with the help of a computer. Logical-probabilistic modeling is one of the effective means of describing the structure of a complex system and quantitatively evaluating its reliability, which was the basis of our application. The reliability assessment process included the following stages, which were reflected in the application: 1) Construction of a graphical scheme of the structural reliability of the system; 2) Transformation of the graphic scheme into a logical representation and modeling of the shortest ways of successful functioning of the system; 3) Description of system operability condition with logical function in the form of disjunctive normal form (DNF); 4) Transformation of DNF into orthogonal disjunction normal form (ODNF) using the orthogonalization algorithm; 5) Replacing logical elements with probabilistic elements in ODNF, obtaining a reliability estimation polynomial and quantifying reliability; 6) Calculation of “weights” of elements of system. Using the logical-probabilistic methods, models and algorithms discussed in the paper, a special software was created, by means of which a quantitative assessment of the reliability of systems of a complex structure is produced. As a result, structural analysis of systems, research, and designing of optimal structure systems are carried out.

**Keywords :** complex systems, logical-probabilistic methods, orthogonalization algorithm, reliability of systems, “weights” of elements

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