

QUANTITATIVE ESTIMATION OF THE RISK OF AN INCREASE IN THE COST OF SPACE HARDWARE PROTOTYPING

*Institute of Technical Mechanics
of the National Academy of Sciences of Ukraine and the State Space Agency of Ukraine
15 Leshko-Popel St., Dnipro 49005, Ukraine; e-mail: sazinana@ukr.net*

The goal of this work is to develop a methodological approach to quantitative estimation of the risk of an increase in the cost of space hardware prototyping.

The paper considers a technology and mathematical models for quantitative estimation of the risk of an increase in the cost of a developmental work on space hardware prototyping. The main cause of the risk of development cost increase is that data used in expected cost estimation are incomplete and inaccurate. The risk level is estimated as the probability of the possible cost of an R&D project exceeding a critical (for the investor) value.

The risk estimation technology is constructed on the basis of the Monte Carlo method embedded in a simulation model. The Monte Carlo method is based on an analytico-probabilistic model (a deterministic mathematical model and a probabilistic model with known distribution functions (laws)).

The uniqueness, novelty, and technical complexity of space hardware prototypes do not allow one to construct any analytico-probabilistic model. This paper presents a mathematical model equivalent to an analytico-probabilistic one.

The paper substantiates the appropriateness of a homomorphic mapping of a possibilistic space of random variables into a probabilistic space; i.e. in this case the proposed model is equivalent to an analytico-probabilistic one.

The key component of the simulation model is the mathematical model of the development cost of a space hardware prototype. The cost model is based on a component-by-component analogy for relatively simple components of the space hardware prototype, moving (upward) along the weighted oriented tree graph that models the engineering structure of the space hardware prototype, and fuzzy methods.

The proposed methodological approach may be used in the construction of a simulation model for quantitative estimation of the risk of a decrease in the efficiency of use of the prototype under development. To do this, it will be sufficient to replace the mathematical model of development cost with a mathematical model of expected efficiency.

Keywords: *analytico-probabilistic model, space hardware prototype, investment project, Monte Carlo method, data uncertainty, risk level, probability distribution function, possibility distribution function.*

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