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Wings to the Research

Opinion

Technology of Mathematical Modeling and Virtualization of Testing Electronics of Robotic Complexes for External Influencing Factors at all Stages of the Life Cycle

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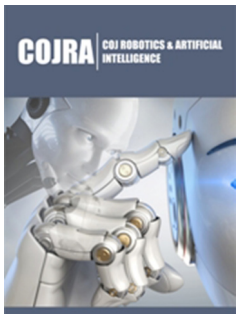

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Opinion

Electronics is widely used in most Robotic Systems (RS). Unfortunately, accidents related to failures in the operation of RS electronics have become more frequent in the world. Created without end-to-end computer-aided design and without the use of complex modeling, it is doomed to low reliability and failures during operation. The use of RS electronics simulation at the early design stages before the prototype is manufactured will allow avoiding RS failures, significantly reducing the number of failures at the prototype testing stage, thereby reducing:

A. number of field tests.

B. the number of iterations to refine the schemes and structures;

C. RS development costs

while improving quality and reliability, including in critical operating modes, making the RS competitive in the domestic and international markets. The use of only full-scale tests of the RS electronics for external influencing factors without the use of simulation is uninformative and inefficient, since most of the possible failures of the RS electronics are not tracked at the design stage; during tests, critical modes are not checked (either technically impossible or expensive due to possible failures of the tested products); due to flaws in the design of RS electronics, revealed by testing, many iterations are possible: project refinement - prototype testing - project refinement, etc., which significantly increases the development time and cost; in full-scale tests, it is practically impossible to reproduce complex (simultaneously acting) effects; it is impossible to install sensors at all points of the RS electronics design and control their behavior, the choice of control points during testing is subjective and relies mainly on experience and intuition.

To date, the issue of standardization of computer-aided design systems and virtual testing of electronics - electronic equipment and electronic component base, which form the basis of electronics digital twins, has acquired high importance. Since 2020, I have been the Chairman of the technical committee for standardization № 165 «Computer-aided design of electronics». For 30 years, my research team has developed a technology for mathematical modeling and virtualization of testing electronics of robotic complexes for external influencing factors at all stages of the life cycle. To implement and implement this technology, we have developed:

Software - Automated system for ensuring the reliability and quality of equipment (ASONIKA) (https://asonika.com/). There are no analogues of the ASONIKA system in the world. I demonstrated the ASONIKA system in the USA, Canada, Germany, China, India, Israel.

Standards:

A. GOST R 60.0.7.2-2020 Robots and robotic devices. Technology of mathematical modeling and virtualization of testing of basic elements of robotic systems for external influencing factors at all stages of the life cycle.

B. GOST R 60.0.7.3-2020 Robots and robotic devices. The method of mathematical modeling of reliability indicators and virtualization of reliability tests of the basic elements of robotic systems in the design.

C. GOST R 60.0.7.4-2020 Robots and robotic devices. Methods of mathematical modeling and virtualization of testing the basic elements of robotic systems for electromagnetic effects during design.

D. GOST R 60.0.7.5-2020 Robots and robotic devices. Methods for building databases of electronic components and structural materials for mathematical modeling and virtualization of testing the basic elements of robotic systems for external influencing factors at all stages of the life cycle.

E. We are ready to cooperate on these issues with interested organizations and scientists around the world.