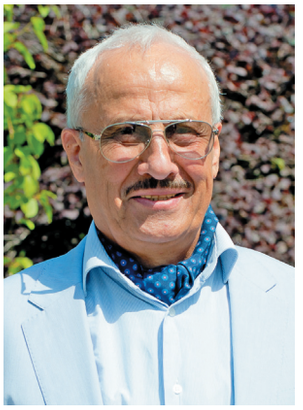
Development of the subject matter of the Dependability Journal in 2020



Dear colleagues,

The year 2020 that marks the 70th anniversary of dependability as a science and practicehas begun. Within a relatively short period of time the discipline of dependability became one of the scientific pillars of the development and operation of technical facilities and systems. The first two decades of the development of dependability were marked by an exceptionally high interest in this science by researchers in many countries. The novelty of the problems, the applicable nature, the pressing practical need for solutions, the opportunity to contribute to the new field of knowledge, all of these enabled the establishment of dependability theory.

Progress in the area of dependability enabled the construction of complex multifunctional technical systems. That, in turn, lead to the necessityof solving much more complicated problems of analysis and synthesis of system dependability. For instance, it was required to integrate various forms of redundancy (structural, time, functional, etc.). A strict assessment of the dependability level of complex redundant technical systems through known methods was complicated. Henceis the wide application of methods based on the following two premises:

1. The method is to take into consideration those items or conditions of operation of a technical system that greatly contribute to its dependability. That means that the system's items or conditions of operation (regardless of their number) can be ignored if their contribution to the system dependability is below the value that is acceptable in engineering terms;

2. The method is to be practically applicable in the work of dependability services of enterprises.

An example of implementation of the first premise is the Pareto chart that – as part of a number of practical problems – helped extract relatively small composite groups of the most significant items. Analysis of complex electronic systems often involved assumptions of no consequences and constant failure and recovery rates, which usually did not contradict practical data and allowed using applied mathematics of Markov processes. That mathematics was also applied in dependability management of complex technical systems in operation after the burn-in period and up to wear and ageing.

As the dependability of systems improved, obtaining the required quantities of current statistical data on failures became a problem. Data became incomplete and insufficiently reliable. In this context, the solution to the problems of dependability required the application of the mathematics of fuzzy sets theory, possibility theory, interval averages. That enabled a mathematical integration of all available information on item dependability: statistical data, expert opinions, technological prerequisites, etc. As the result, a sufficiently extensive image of system dependability was created. However, the solutions adopted as part of dependability management raised significant concerns, as the reliability of the initial information and predictions did not always satisfy the system's users. It became natural to manage the dependability of complex systems based on risk assessment: managing investment to enable dependability, managing the useful life of systems, evaluating the criticality of failures, managing the maintenance operation, etc.

The innovative technologies of artificial intelligence significantly extend the boundaries of dependability theory. It is now possible to reliably predict hazardous events and critical failures, reduce the levels of risk, improve the confidence in the made decisions. The methods and models of Data Science enable proactive dependability and safety management of complex technical systems. Hence, to the subject matter of the classical dependability theory, that was defined by the USSR Academy of Sciences member Aksel Berg, it should be added that "under the current conditions, dependability theory is seeking ways of improving dependability based on risk assessment and artificial intelligence".

The topics of the Dependability Journal go hand in hand with the development of the system dependability science and in 2020 will include structural and functional dependability, functional safety, fault tolerance and survivability of systems, standardization and certification, risk management, as well as innovative technologies in dependability and safety. A the same time, the authors are encouraged to review the publications in the respective areas of research, especially foreign ones. This requirement of the Editorial Board is motivated by the rules generally accepted worldwide.

I wish the readers of the Dependability Journal success in their research and practical endeavors, new original findings.

Best regards, Prof. Igor Shubinsky,
Doctor of Engineering Editor-in-Chief