

4.1.22. THE CONCEPT OF IMPROVING THE RELIABILITY OF NONDESTRUCTIVE TESTING EQUIPMENT

Dianov V.N.,
Moscow State Industrial University, Moscow, Russia

This work is based on a discovery (V.N. Dianov "Properties of passive radio-electronic equipment", Moscow, MSIU, 2007, page 120) and dealing with significant new properties of passive devices, manifested, in particular, in the form of the relationship between failures and latent defects. The concept of substantial improvement in reliability and quality put into the modern equipment of nondestructive testing is based on the methods of diagnosis of active elements by detecting and recording them in the sources of failure. Predicted a priori, and then proved mathematically and verified experimentally faulty status of items of equipment as a set of informative guidelines (additional electromagnetic radiation, the formation of microresonant contours, subharmonic oscillations, phase change, the delay of signals and some other) allows not only guaranteed to detect failures, but also to fix the border state before failure, as well as to implement the hardware (for example sensors failures) reliable and cheap. the latter circumstance is particularly important when compared with other (passive) methods of diagnosis, particularly with the use of wavelet analysis, are developing today in our country and abroad and providing for a substantial software support and also great material and time costs in the development of the original algorithms.

In accordance with existing rules, one of the most important indicators of quality is the reliability of technical system (object). On the other side, the work of any technical system can be characterized by its quality, which refers to a set of properties that determine the system's ability to perform some problems when it was created. In turn, one of the characteristics of reliability is trouble-free – property of the object continuously remain operational for some time. Characterized by a failure in accordance with GOST as selfavoidable failure, it is therefore evident that the concept of “failsafe” also includes the concept of “failure”. Thus, introducing an active diagnostic trouble codes (by fixing their sources), through the registration of the intermediate state (before failure) and a variety of informative parameters, we derive the concept of a (failed) in an independent category (non failure). Given that the concept of “quality” operates with such concepts as defects explicit and implicit, that is nondetectable in the normative and technical documentation (NTD), establishes a relationship between failures and latent defects.

Therefore, the existing basic properties of reliability of technical systems appropriate to add a new property – “non failure”. The introduction of such concepts in quality, in particular through the measurement of failure contactless and contact methods that will enable them to manage, using a thin (small up to 10 – 15 microns, the size of) the boundary

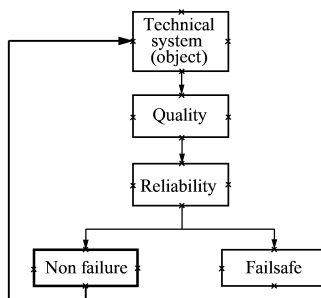


Fig. 1 New property of technical systems – “non failure” – and its relationship to existing structure (thick lines).

In this figure, the reliability associated with the quality of a non failure feedback (thick lines)

layer before failure state of passive devices. In accordance with the above, this structure can be represented as follows.

Particular challenge in creating electronic systems of complex objects is the problem of electromagnetic compatibility. Given the fact that a malfunctioning (failure) state of passive elements of the equipment there is electromagnetic radiation that exceeds the permitted limits, must face the challenge of neutralizing the internal (inside equipment) electromagnetic interference. On the other hand, given that the faulty section is a resonance circuit (one or a few), as well known from radio engineering principle of reversibility of antennas (i.e., the failed plot may be a transmitter and receiver signals) should solve the problem of neutralizing the external electromagnetic interference, operating primarily on the faulty sections. Therefore, for the especially important equipment offers a comprehensive solution, is, on the one side, the use of contact and contactless sensors of failure, and on the other side – the proposed algorithms distinguish between internal and external electromagnetic interference between them. The report gives examples of this approach for electronic vehicles, including submarines and aircraft. Also consider the reliability and quality of modern monitoring equipment and embedded diagnostics in equipment mentioned above, contact and contactless sensors. Thus, considered in the concept of an integrated solution of increasing the reliability and quality on the basis of “non failure” allows you to design, build and operation of equipment at a new level.

References:

1. GOST 27.002–89. “Reliability in engineering. The notion. The terms and definitions.
2. Mechanical Engineering. Encyclopedia. Section III. The technology of production machines. Vol III-7. Measurement, monitoring, testing and diagnostics. – M., “Mechanical Engineering”, 2001
3. Dianov, V.N. “Non failure” of equipment as a method of improving its quality. Materials science and practical conference “Innovations in the development of information and communication technologies” INFO-2009. Russia, Sochi, 1-10 October 2009., Pp. 50 – 52.