*Materials of Conferences*

## ANALYSIS AND RESISTANCE ENSURING TO MECHANICAL INFLUENCE OF ELECTRONICS STRUCTURES MOUNTED ON VIBRATION ISOLATORS (ASONIKA-V)

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Method for automated synthesis of electronic structures on vibration isolators, resistant to mechanical influence.

The basis of this method is an electronic model (EM) of electronic structures that is stored in a PDM-system ASONIKA-UM, which is part of ASONIKA. Electronic model is a single space of parameters and variables of the model range. It is reflecting the design and technological implementation of the individual parts or the electronic structure in general. EM is the result of design and comprehensive research of electronic structure features by means of mathematical modeling which is carried out, in turn, within the information («electronic») collaboration between developers at any stage of product's life cycle using CALS-ideology. An important component of the method is a reference database that stores the characteristics of typical vibration isolators and materials of the structure.

The proposed method allows for the automated synthesis and analysis of electronic structures on vibration isolators in order to ensure their resistance to mechanical influence:

1. On the basis of three-dimensional electronic structural model is to build a model structures in the subsystem ASONIKA-V.

2. Entering experimental characteristics obtained during the research of electronic structures using an automated shaker.

3. Identification of vibration isolators' unknown parameters on the basis of the experimental characteristics of structure.

4. Entering vibration isolators parameters. At this stage, the automatic import of the parameters obtained from the identification or selection of standard vibration isolators from the reference database (DB). At this stage, dependency from the temperature parameters can be adjusted using the results of the thermal calculation in the subsystem ASONIKA-T.

5. Structure optimization stage. At this stage, the structure synthesis is automated to meet the requirements specified in the technical documentation (TD).

6. Parametrical optimization. At this stage, based on the use of optimization techniques, the automated selection of vibration isolators' mechanical properties occurs, which is needed to meet the requirements of the TD.

7. Structural synthesis of the structure. At this stage, the vibration isolators' automatic variation and location of their coordinates occurs in order to meet the requirements of the TD.

8. Multi-level vibration insulation is used in case of inability to meet the requirements of TD as a result of the above methods of finding the best embodiment. At this stage in an interactive mode changes are made in the design of electronics.

9. Analysis of the resulting design and obtaining the calculation results in the form of graphic dependences of the acceleration amplitudes and the frequency displacements or exposure time. At this stage, the calculation results can be obtained for the transmission to ASONIKA-M subsystem.

10. The analysis of results and decision making. If the received electronic design characteristics do not meet the requirements of the TD, then changes are made to the electronic model, then the process of analysis and design synthesis repeats.

The organization of an automated subsystem ASONIKA-V.

Based on the above-described method of the electronic structures synthesis, an automated subsystem ASONIKA-V has been developed. This subsystem is designed to analyze the mechanical characteristics and synthesis of cabinets structures, racks and blocks electronics, mounted on vibration isolators, under the influence of harmonic vibration, random vibration, shock loads, linear acceleration, under the influence of acoustic noise, as well as complex mechanical influences and decision-making on the basis of the mechanical characteristics in order to ensure structures stability of electronic to mechanical stress. The design may include a variety of elements in the form of rectangular parallelepipeds with different dimensions and can also be applied to multi-level vibration isolation. According to the results, the subsystem user can obtain output information on the accelerations and displacements of structural elements of electronic on vibration isolators.

Program implemented problems of parametric and structural synthesis:

1) the possibility of optimal choice of the coefficients of mechanical losses (damping), and stiffness vibration isolators on all axes;

2) the possibility of optimal choice of the coordinates of the location and number of vibration isolators.

The main condition is not exceeding the allowable accelerations in the structure (usually the allowable accelerations of electronic components with different mechanical influences). Implemented

the problem of identifying the unknown mechanical properties of vibration isolators with computer measuring shaker.

Computer modeling of mechanical processes in electronic structures on vibration isolators is necessary for:

• to verify the stability requirements of the electronic structure on vibration isolators under specified mechanical conditions;

• to identify the opportunity to reduce the weight and the dimensions of electronic structure on vibration isolators;

• to improve the electronic structure's stability to mechanical influences by setting the parameters of vibration isolators, their number and location coordinates;

• to create a program of laboratory and acceptance testing of electronic structures on vibration isolators and to verify whether it will pass those tests.

Automated subsystem is expedient to use in the development of electronic structures that work under the influence of vibration, shock and acoustic noise in a wide range of frequencies.

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## AN AUTOMATED SYSTEM FOR ENSURING THE RELIABILITY AND THE QUALITY OF THE EQUIPMENT (ASONIKA)

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An automated system for ensuring reliability and quality of the equipment (ASONIKA) can help realize computer-aided design and an integrated computer simulation of highly reliable radio electronic means (REM) of moving objects in accordance with the requirements of CALS-technologies at the stages of engineering-production-exploitation.

Operation of onboard REM is characterized by combination of rigid external factors that act simultaneously, which leads to a systemic failure. During testing, such failures are difficult to detect since there are no stands that would allow to fully recreate simultaneously electrical functioning processes, the accompanying thermal, mechanical, aerodynamic, radiation and other environmental effects, technological effects of random variation parameters, aging, corrosion and other degradation factors. The problem is complicated by the fact that modern REM include advanced microelectronic products with certain physical and technological features, which should also be considered in the complex mathematical modeling. All of these factors and interrelated effects must be properly taken into account during the technological engineering that can only be performed by a computer. In this case, the causes of system failures can really be pre-identified and eliminated and high reliability of the REM is provided.

ASONIKA is designed to solve four major problems existing in the development of modern REM:

1) the problems of preventing possible failures during the operation in the early stages of engineering due to the complex modeling of heterogeneous physical processes;

2) the problems of human safety when flying on airplanes (prevention of crashes) due to complex automated analysis system based on the control of the aircraft created an electronic model for all types of external destabilizing factors, including those in critical conditions;

3) the problems of reducing time and costs of the engineering due to availability of equipment offered to a developer by software and the adequacy of the modeling results;

4) the problem of automating workflow, and creating an electronic model of a product offered by the integration of software tools within the PDM-system storage and management of engineering data and product lifecycle management (equipment).

ASONIKA – Russia's first automated system for complex modeling of physical processes in the electronic equipment that is recommended to replace the testing of electronic equipment modeling in the early stages of engineering, which allows you to create competitive equipment in the shortest possible time and with minimal costs.

The developer of the system ASONIKA is «Scientific school of modeling, information technology and automated systems». The founder and leader of the scientific school is Prof. A. Shalumov. The basic principle of the scientific school – unity of 4 components: Education – Science – Manufacturing – Business. Scientific school has published over 300 books, manuals and articles.

ASONIKA has no analogues In Russian Federation. The information about any foreign analogues is missing from the press.

ASONIKA system is used in many Russian companies that are developing electronic devices. Use of ASONIKA in the engineering and the technical expertise of prototype electronic means allows to reduce the complexity of the project research (in some cases up to 35–40 %), improve the quality of the samples (above all – their reliability because of early detection and elimination of preconditions to failure, associated with the irrational schematic and engineering decisions), cost savings by reducing the amount of work needed to create and to study the models, reduce the volume of all types of tests (up to 10–15 %).

The methodological basis for solving assigned tasks is developed scientific principles of mathematical field modeling theory and processes of different physical nature, interacting with each other