

TABLE OF CONTENTS

GENERAL PROBLEMS OF ELECTROMECHANICS

Zakharenko A.B., Martinova S.A. (JSC «VNIEM Corporation»)

CONFIGURATION OF EQUIPMENT FOR MEASURING MAGNETIC INDUCTION OF PERMANENT MAGNETS AT OPERATING TEMPERATURE.....3

A construction of device (equipment) simulating magnetic system of magnetolectric machine is proposed. The device used together with the test bench enables to perform incoming control of permanent magnets in part of magnetic induction measurement at operating temperature.

Key words: magnetolectric machine, device, magnetic induction, similarity factor.

Gorodetsky R.S., Getcha V.Ya. (JSC «VNIEM Corporation»)

PROBLEMS OF ACHIEVEMENT OF LONG-TERM RESOURCE OF SUPPORTS OF DEVICES OPERATING IN ROLLING MODE. THE ALTERNATE SOLUTION.....7

A problem of achievement of long-term resource (more than 80,000 h) of supports of devices with rocking shaft at rocking amplitude of more than $\pm 20^\circ$ is described. Rolling bearings serve as supports due to the fact that application of supports with elasticity friction at rocking amplitude of no more than $\pm 20^\circ$ is not possible. However, the resource of rolling bearings is well below of the resource at rolling mode than in rotary one. An example of a variant of engineering solution enabling to increase the resource of rolling-contact bearing at operation in rolling mode is given herein.

Key words: space engineering, resource, wear, rolling operating mode, rolling bearing, elasticity friction supports.

Shcherbakov V.I. (JSC «VNIEM Corporation»)

DETERMINATION OF RELATIVE DIMENSIONS OF DEVICE FOR CONTROL AND CHARACTERIZATION OF ELECTROMAGNETIC RADIATION OF ELECTROMECHANICAL EQUIPMENT COMPONENTS BASED ON TEM-CHAMBER.....11

A design technique of unsymmetrical Tem-chamber design in relative units was proposed based on analysis of dependence of main electromagnetic parameters of TEM-chamber (wave impedance, upper frequency limit, voltage standing-wave ratio) on dimensions of transversal and longitudinal sections.

Key words: TEM-chamber, wave impedance, standing-wave factor, higher-order mode, multimode mode, resonant length, coaxial cable.

Shcherbakov V.I. (JSC «VNIEM Corporation»)

DETERMINATION OF FIELD EQUITABILITY INSIDE THE OPERATING AREA OF DEVICE FOR CONTROL AND CHARACTERIZATION OF ELECTROMAGNETIC RADIATION OF ELECTROMECHANICAL EQUIPMENT COMPONENTS BASED ON TEM-CHAMBER.....15

Consideration on the most general provisions justifying possibility to use TEM-chamber for measurement of parameters of casual radiation of electromechanical equipment components. Measurements of voltage standing-wave ratio depending on overall dimensions of the equipment under test and equitability of calibration coefficient in work area, which are necessary to determine dimensions of the work area and errors, are represented in this article.

Key words: TEM-chamber, dipole moment, dipole, electric field, casual radiation measurement, standing-wave factor, direction diagram, electromagnetic compatibility.

SPACE ELECTROMECHANICS. SPACECRAFT

Hegay V.V., Kim V.P., Shirokov R.V. (IZMIRAN)

Karelin A.V. (FSUE TsNIMASH)

PLASMA PARAMETERS OF NEAR-EARTH SPACE ENVIRONMENT IN AREA OF LOW-ALTITUDE SATELLITE ORBITS FOR ASSESSMENT OF ITS POSSIBLE INFLUENCE ON ROCKET-AND-SPACE EQUIPMENT.....21

Numerical characteristics of near-Earth space environment (NSE) plasma in the area of low-altitude satellite orbits (in the range of 200 – 1000 km) for assessment of its possible influence on rocket-and-space equipment, i.e. concentrated in F-region and upper part of the Earth's ionosphere are represented. The characteristics are calculated on base of modern empirical model of ionosphere IRI for different levels of solar activity, and can be directly used for assessment of interaction effects of low-orbiting spacecraft (SC) with ionospheric plasma. The main effects of potential influence of NSE plasma on low-orbiting SC are discussed in short-form.

Key words: near-Earth space environment, ionospheric plasma, low-orbiting spacecraft.

Steganov G.B., Kargu D.L., Vlasov V.A. (Military space academy n.a. A.F. Mozhaysky)

Korshunov G.A. (LLC «NPO «Delta»)

MATHEMATICAL MODEL OF HEAT EFFECT DYNAMICS OF CURRENT IMPULSE ON OVERVOLTAGE LIMITER MULTILAYER STRUCTURE.....25

An analysis of specialized overvoltage limiter of filter unit for protection of spacecraft power circuits against peak overvoltages is offered. A difference equation system solution is considered. Results of test numerical solution of assigned task enabling to determine variables of assured failure of specialized overvoltage limiter and protection circuit on its basis at influence of power pulse currents are represented.

Key words: overvoltage limiter, multilayer structure, non-stationary thermal conditions, grid model, fault withstandability.

Lavrinikov I.S. (JSC «VNIEM Corporation»)

EMPLOYMENT OF UHF-SWITCHES FOR SUPPRESSION OF INTERFERENCE CHALLENGING SIGNAL IN SMALL SPACECRAFT ANTENNA-FEEDER DEVICES.....31

A cause of origin of interference challenging signal in small spacecraft antenna-feeder devices is considered. A scheme of units and logic of operation command-measuring system with possibility to suppress interferences is brought. Possible variants of interlock structures of challenging signal are described. A comparison of radioelectronic components existent on the market to solve this problem is presented.

Key words: interference, UHF-switches: ferrite, p-i-n-diode, semiconducting, electromechanical, micro-electromechanical, command-measuring system, challenging signal, signal blocking.

PRODUCTS AND EQUIPMENT TEST PROCEDURES

Grabilin A.O., Zubrenkov B.I., Pustobayev M.V.,

Sudomoyev A.D., Shmatkov A.V. (JSC «VNIEM Corporation»)

SIMULATING SHOCK LOADING MODES ON SPACECRAFT HARDWARE AT ACTUATION OF DIVISION PYRO DEVICES.....35

A method simulating impact loads from pyro devices on impact spectrum using the developed bench is represented. Parameters of bench architecture effecting on impact spectrum components and impact spectral peak are revealed. Peculiarities of simulated impact spectrum components are analyzed; recommendations on assignment of tolerance ranges composing impact spectrum at testing is stated.

Key words: spacecraft, impact action, tests, calculation, spectrum impact, pyro device.

ELECTROMECHANICS AND SOCIOECONOMIC DEVELOPMENT OF THE COUNTRY

Khavalin A.L. (Saratov State University)

EMPLOYMENT OF STRIPE DOMAIN STRUCTURES PROPERTIES IN FILM-TYPE YIG-RESONATORS FOR CREATION OF WEAK MAGNETIC FIELDS TWO-AXIS MAGNETOMETER.....43

A construction of magnetometer using properties of stripe domain structures in yttrium iron garnet films for simultaneous determination of dimensions and direction of earth magnetic field inductance vector, or geomagnetic field created by a ferrous object is represented. The similar devices can be used in magnetic geologic exploration, diagnostics and revelation of objects containing ferrum, earth magnetic field navigation, in guiding devices, and contactless actuation for dedicated applications.

Key words: magnetic field sensor, yttrium iron garnet, stripe domain structure, geomagnetic field induction convertor, magnetically operated generator.

Anisimov V.Yu., Pinchuk A.V. (JSC «VNIEM Corporation»)

Molokanov G.G. (SRF Military academy n.a. Peter the Great)

METHODIC APPROACH TO JUSTIFICATION OF REQUIREMENTS TO EARTH REMOTE SENSING SPACECRAFT PERSPECTIVE SYSTEM.....49

An approach to solve the problem of justification of requirements for perspective system of ERS SC based on its presentation as three-level hierarchy system is described.

Key words: ERS SC perspective system, requirements, trajectory, equifinality.

Bezrodnikh I.P., Morozova E.I., Petrukovich A.A. (IKI RSA)

Semyonov V.T. (JSC «VNIEM Corporation»)

METHODIC APPROACH TO JUSTIFICATION OF REQUIREMENTS TO EARTH REMOTE SENSING SPACECRAFT PERSPECTIVE SYSTEM.....53

A radiation absorbed dose on orbit and surface of the Mars for minimum solar activity was assessed. A variant of optimal radiation burden for astronaut-inhabited spacecraft, when mass shielding thickness is formed on account of SC body and complementary elements providing a crew life support is considered. It was shown, that the radiation absorbed dose on Mars orbit under a spherical shield of aluminum of 20 g/cm² mass thickness had a value near 0,4 rads/year of solar space rays (SSR) particles. In case of superpower solar burst similar to one in May 11 of 1959 and November 12 of 1960 the radiation level will not exceed 5 rads per burst. The absorbed dose of galactic space rays particle (GSR) on Mars orbit under the spherical shield of 20 g/cm² was ~10 rads/year. On surface of the Mars the radiation dose of SSR particles was ~0,11 rads/year and of GSR particles near ~5,1 rads/year (with an allowance for secondary particles). In case of superpower solar burst the radiation absorbed dose on Mars surface will increase by ~2 rads. Based on results of assessments it was made a conclusion, that the Mars atmosphere protects the planet against space radiation efficiently. The presented calculations can serve as a base for assessment of radiation environment at planning missions to Mars during a minimum of solar activity 2018 – 2022.

Key words: Mars, Martian atmosphere, radiation, space rays, spacecraft.