

TABLE OF CONTENTS

GENERAL PROBLEMS OF ELECTROMECHANICS

Verechagin V.P., Klabukov V.A. (FGUE «NPP VNIEM»)

MATHEMATICAL MODEL OF AXIAL MAGNETIC BEARING INCLUDING EDDY CURRENTS.....3

A mathematical model, enabling to register influence of eddy currents appearing in the solid iron core, was developed based on electric circuit substitution of axial magnetic bearing. A possibility to use a simpler mathematical model of magnetic bearing for hardware in modern systems controlling magnetic bearings was considered. An analysis of electromagnetic processes in solid iron core was carried out with application of this model.

Key words: axial magnetic bearing, solid iron core, eddy currents, mathematical model.

Shabunovich V.I. (FGUE «NPP VNIEM»)

CALCULATING FINITE ELEMENT METLAP JUNCTIONS MODEL OF METAL SHEETS.....9

Results of finite element calculation of the sample model of riveted joint of overlapped metal sheets at liner static and harmonic loading are brought up. The computation was carried out with the help of PATRAN-NASTRAN complex. Results of static calculations and ones of experimental measurements are compared.

Key words: finite elements, overlapped sheets joint sample, natural frequencies, harmonic analysis.

SPACE ELECTROMECHANICS. SPACECRAFT

Fromeev E.V., Kazantsev S.G., Kozhevnikov O.V., Khiblin I.N., Shmatkov A.V. (FGUE «NPP VNIEM»)

Amelin L.A. (OJSV «NIEM»)

STATIC TEST BED FOR FUTURE-ORIENTED SMALL SPACECRAFT PLATFORMS.....13

Results of development and creation of static test bed for future-oriented small spacecraft platforms are presented. Test data of universal satellite platform UKP-250 dummy made of honeycomb panels are brought up.

Key words: qualification testing, static loading, honeycomb panel, ultimate strength, carrying capacity.

Bezrodnikh I.P., Morozova E.I., Petrukovich A.A. (SRI RAS)

Kazantsev S.G., Kotchetov I.V., Semyonov V.T. (FGUE «NPP VNIEM»)

SC «IONOSPHERE» ORBIT RADIATION ENVIRONMENT.....19

Assessment of radiation environment on the orbit and inboard of the «Ionosphere» SC was made. It was shown that the radiation absorbed dose inside the «Ionosphere» SC during 8 active life years will not exceed 4 krad. Results of mathematical modeling of proton passing with 10⁵ GeV energy and ferrum core with 26 GeV energy through the aluminium plate are presented. A conclusion, that single cores of chemical elements from hydrogen to ferrum with energy from several hundreds of MeV to several GeV per nucleon do not intimidate substantially a normal operation of SC electronic hardware, was made on base of linear energy transfer of galactic cosmic rays and sun space rays particles to the matter. A conclusion, that the maximal particles flow rate captured in geomagnetic field and maximal radiation absorbed dose from them are to be expected not at maximal flare activity of the Sun, but at down grade and near flare activity minimum when powerful recurrent high-speed flows of solar wind plasma are probable, was made based on the results of experimental researches on dependence of flow particles rate of outer and inner radiation belt of the Earth on solar activity.

Key words: spacecraft, space rays, radiation belt, radiation environment on orbit.

Ganzburg M.F., Gruzdev A.I., Trofimenko V.I. (OJSV «AVEKS»)

PECULIARITIES OF CONSTRUCTION OF CONTROL AND PROTECTION HARDWARE OF HIGH-VOLTAGE

LITHIUM-ION STORAGE BATTERIES FOR SPACECRAFT POWER SUPPLY SYSTEMS.....29

System approaches and sheet-oriented solutions made by OJSV «AVEKS» at creation of control and protection equipment of high voltage lithium-ion storage batteries are considered. A comparative analysis of variants of voltage levelling hardware of by-pass devices in storage battery is brought up. A possibility to use developed voltage levelling transformer units for keeping operability of batteries at loss of capacity or failure of one or several accumulators was shown experimentally.

Key words: high-voltage storage battery, lithium-ion accumulator, control and protection equipment, levelling device, by-pass device.

Pustobayev M.V., Engalichev F.H., Meshchikhin I.A., Tchebotarev S.V. (FGUE «NPP VNIEM»)

SPACE GAMMA-RAY TELESCOPE CONSTRUCTION DEVELOPMENT AND PRELIMINARY CALCULATIONS.....35

The article deals with a data on development and preliminary calculations of space gamma-ray telescope construction «Gamma-400» with application of advanced materials. Two variants of constructions were developed according to requirements of the customer. Calculations of strength and stiffness of construction were fulfilled for flight variant. It was shown that the construction satisfies all requirements.

Key words: spacecraft, gamma-ray telescope, componentry, honeycomb panels, detectors, carbonplastic cores, strength calculation, proper frequencies analysis, numerical modeling.

ELECTROMECHANICS AND SOCIOECONOMIC DEVELOPMENT OF THE COUNTRY

Kazantsev S.G., Ovcharenko T.N. (FGUE «NPP VNIEM»)

POLAR AND RETICULAR ANISOTROPY OF MICRO-HARDNESS OF PERSPECTIVE PIEZOELECTRICS.....41

Results of development of research method of monocrystals micro-hardness based on statistical data processing method of automated measurements at different loading applied to indenter are presented, as well as results of research of monocrystals micro-hardness with covalent and ionic binding executed as per Knoop methodology are given. In consequence of conducted researches a polar and reticular anisotropy of micro-hardness was found in langasite group crystals.

Key words: micro-hardness as per Knoop, micro-hardness as per Vickers, polar and reticular anisotropy, indenter.

Kazantsev S.G., Ovcharenko T.N. (FGUE «NPP VNIEM»)

CALCULATION AND EXPERIMENTAL RESEARCH OF ANISOTROPY OF ELASTIC PROPERTIES

OF LANGASITE GROUP PIEZOELECTRICAL MONOCRYSTALS.....51

Results of calculation and experimental researches of anisotropy of elastic properties of monocrystals of lanthanum gallic silicate and lanthanum gallic tantalite are presented in this article. With the help of mathematical packet MathCAD 14.0 numerical values of speeds of quasilongitudinal and quasitransverse elastic waves in crystals were obtained and sections of their indicatory surfaces were built with various coordinate planes. It has been found, that the form of indicatory surfaces of phase rates of elastic waves makes a picture of anisotropy of micro-hardness of piezoelectrical monocrystals of langasite group – presence and position of symmetry axes of the 2nd and 3rd order.

Key words: langasite group monocrystals, acoustic waves, Green – Christoffel tensor, microhardness, anisotropy of elastic properties.