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GEODESY AND MINE SURVEY

PROSPECTS OF USE OF SPECIAL GEODETIC PROJECTIONS AND LOCAL COORDINATE SYSTEM

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In Russia are currently running the implementation of a state coordinate system-2011. Its successful implementation should be adequately provided mathematical, methodological research and technological schemes. Very topical issues of creation of local coordinate systems. Their creation demanded both in individual countries and regions geographically large countries, such as the Russian Federation. There are also increased requirements to a minimum distortion in the creation of cartographic materials about the area where you are design, survey, construction and operation of the facility construction. Additionally there are particular large-scale mapping in mountainous terrain. It should be a conformal projection that is optimal for the solution of geodetic engineering tasks for a particular area.

This article summarizes certain provisions of the applicable regulations and rules. Discusses examples of establishing local coordinate systems. Given the current level of implementation of coordinatization and information, computing power needs to be refined mathematical formulas and algorithms used by the special projections and local coordinate systems. Some suggestions and conclusions.

Key words: local coordinate system, the engineering-geodetic survey, special geodetic projection, distortion, precision, conversion, algorithms.

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QUASIGEOID MODERN GLOBAL MODELS: ACCURACY CHARACTERISTICS AND RESOLUTION

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On the basis of global models of the gravitational field of the Earth such as EIGEN-6C, EIGEN-6C3stat, GO_CONS_GCF_2_TIM_R5 and EIGEN-6C4, which are presented on the website of the German Research Centre for Geosciences (ICGEM) in the form of harmonic coefficients of the geopotential are constructed global quasigeoid models.For accuracy evaluation of the modern global quasigeoid models we performed a comparison of heights anomalies which are obtained from quasigeoid models, with heights which are obtained from the geometric leveling and GNSS measurements for the territories of two different Russian regions.We have carried out a comparison of quasigeoid heights calculated over investigated models and quasigeoid heights obtained according by the model EGM-2008. The paper presents degree dispersion of quasigeoid heights and their errors. Research of the high degree model EIGEN-6C4 showed improved spatial permission ability and accuracy quasigeoid heights in the study area relatively of the model data EGM-2008 on 5 percents.

Key words: degree dispersion, Global quasigeoid models, Quasigeoid height, models of the Earth’s gravitational field, GNSS technology, EGM-2008, EIGEN-6C, EIGEN-6C3stat, GO_CONS_GCF_2_TIM_R5, EIGEN-6C4.

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ASSESSMENTS PROPERTIES OF EQUAL ACCURACY MEASURED VALUES, OBTAINED BY PSEUDONORMAL OPTIMIZATION CORRELATION WAY

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It is known that in the mathematical models of geodetic constructions the true values of the network parameters are not known. We have only their estimates obtained on the basis of the measurement results, which are accompanied by the inevitable random errors of observations. In this situation, a good quality model parameter estimates obtained using a particular method, is one of the most important conditions for building a "successful" mathematical model of geodetic network. The theory of statistical evaluation determines the quality of the assessments on the properties of unbiasedness and efficiency. We remind that the estimate is unbiased, if the true value of the parameter can be seen as its mathematical expectation or otherwise, the mathematical expectation estimation error should be equal to zero. Evaluation is regarded as effective if it has the lowest dispersion (variance estimation error is minimum) among all other similar estimates obtained by different methods. The article gives a theoretical justification for unbiasedness and efficiency parameters of a mathematical model of geodetic networks estimates obtained by the method pseudonormal optimization for correlation method.

Key words: accuracy evaluation, pseudonormal optimization, pseudoinverse matrix, symmetric matrix, effective evaluation, unbiased assessment, covariance matrix.

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VERTICAL DISPLACEMENT AND GRAVITY CHANGE AFTER CHUYA EARTHQUAKE AT WEST PART OF GORNY ALTAY

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Precise geodesy measurement and gravity observation are important for monitoring study at seismic-activity region. Space geodesy observation started at Gorny Altay from 2000 year. There strong earthquake with 7,3 magnitude was happened at 27.09.2003. Coseismic horizontal right-side shift (2m) was presented at sub-vertical cruck. Post-seismic uplift motion (15-25 mm) was registered at west part of Gorny Altay. Gravity observation by GABL gravimeter presented the decrease at 5-10 microgal. These values agree with geodesy results if we have normal vertical gradient (300 μGal/m). Post-seismic uplift displacement observed at 2004-2012 period.

Key words: space geodesy, GPS method, absolute gravimetry, earthquake, post-seismic vertical motion, Gorny Altay.

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GEODETIC CONTROL OF CONSTRUCTION BRIDGE SUPPORT

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The article describes the geodetic works during construction of bridge support. Developed system of control of initial of the bridges, erected with the use of pipes of large diameter. To control determine the coordinates of the principal axes of the shell accuracy assessment and for decision-making on adjustment of the location of the proposed automated design system, comprising the following sequence of operations: determining the actual coordinates of the control points; automated adjustment in real time with the use of the ellipse of average quadratic errors; determination of the center of the shell and the pivot axis. The developed method determination of roll shells from one station by comparing the actual measured difference of the vertical angles with the design value. The proven effectiveness of a method based on comparative analysis with known methods, and provides a three-dimensional model in determining the roll supports of bridges.

Key words: bridge support, the roll shell, mean square error.

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GEODETIC MONITORING OF THE INTENSE DEFORMED CONDITION OF CRUST OF KUZBASS : GEODETIC CONSTRUCTIONS

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Changes coordinates of points on the earth's surface are the basis of studying the deformation processes. In the traditional information management technologies for exploitation of mineral resources at present to collect such information uses flat model of the earth's crust that do not ensure the adequacy of the crustal blocks. This approach does not guarantee the accuracy and representativeness of information that increases the level of the manifestations of geodynamic phenomena. The author developed the theory of geodetic constructions at creation of geodetic monitoring of the stress-strain state of the crust during the development of the coal deposits of Kuzbass. The main difference between the proposed geodesic constructions is the use of spatial shape as the cell network of the geodynamic polygon, which provides a definition of dynamic parameters in the depth of the

earth crust block. This approach ensures not only the rigidity and reliability of a geodetic network, but also the efficiency.

Key words: geodetic monitoring, geodetic constructions, the blocks of the Earth's crust, geodynamic polygon, rank, geodynamic phenomenon, kinematics.

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THE DECISION OF THE ENGINEERING-GEODETIC ACTIVITIES IN THE MOUNTAIN AREA WITH THE USE OF SPECIAL GEODETIC PROJECTIONS

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The development of engineering and surveying defines increased requirements to a minimum distortion in the creation of cartographic materials about the area where you are design, survey, construction and operation of the facility construction. Therefore, in geotechnical and geophysical work, hydro-energy construction, urban planning, industrial and civil construction, mining surveying jobs in demand special geodetic projection and coordinate system. An additional factor to this need is the terrain. Of course, it must be conformal projection that is optimal for the solution of geodetic engineering tasks for a particular area.

In this article are examples of major engineering facilities in the highlands and the quantitative estimates of distortions in the processing of geodetic measurements and the creation of cartographic materials. This is a highland reservoir in the Republic of Kyrgyzstan and a road tunnel on the highway Bishkek-Osh. The proposed requirements for the selection of special geodetic projections.

Key words: engineering and geodetic works, special geodetic projection, distortion, mountainous terrain, geodetic network, justification, design, topographic maps, reductions of corners, rectangular coordinates, geodetic and surveying networks.

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CALCULATION FOR AMENDMENTS LUNISOLAR TIDE THE RESULTS OF PREVICISION LEVELING

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One of the most important tasks in the study of modern geodynamic processes using geodetic and geophysical methods is to increase the accuracy of instrumental measurements, both through the development of observational techniques, and taking into account the various factors affecting the accuracy of the objects under study. One such factor is the lunar-solar tides in the Earth's crust: under the influence of centrifugal and tidal forces, under the pressure of the atmosphere and winds the elastic earth undergoes deformation.

The formulae for calculating the corrections due to the influences of the Moon and the Sun were suggested, which is very time-consuming. To accelerate and facilitate the process special nomograms for latitudes 45º, 50º, 55º and 60º were designed. In the construction of nomograms for the hour angle t values from 0º to 180º and from 180º to 360º with a step of 5º, and declination δ from -30º to +30º with a step of 5º were applied. According to nomograms plumb inclination components are selected and then are multiplied by the corresponding components of the leveling line, which can be determined by a topographic map with a scale 1 : 25 000. Thus, the article proposes a method for determining the amendments of precision leveling during lunisolar tide using special pallets.

Key words: ground plane, tidal forces, fluctuations in the plumb line, relative height, correction, lunisolar influence, accumulated correction, nomogram.

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REMOTE SENSING, PHOTOGRAMMETRY

METHOD OF VERIFICATION OF TERRESTRIAL LASER SCANNERS

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In the paper the technique of checking the pulse and phase of terrestrial laser scanners, both in the field and in laboratory conditions. The verification method is proposed to follow is-precision measuring vertical and horizontal angles and distances for all types of existing terrestrial laser scanners. As standard tools for investigating the accuracy of the measurement values of linear terrestrial laser scanners are encouraged to use in the field geodetic comparator, and in the laboratory – an interferometer. The investigation of precision angular measurements recommended using high-precision total stations. The unique research methodology distances is that you can even calibrate instruments that do not have centering devices, and studies of the angular values – there is no need to establish and maintain a complex geodesic polygon. Practical experience of work with the help of the proposed method showed its efficiency.

Key words: terrestrial laser scanner, the method verification, accuracy, standard, metrological characteristics, mistake, range.

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EXPERIMENTAL STUDIES OF CONTEMPORARY SOFTWARE FOR MODELING GEOSPATIAL

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This paper presents a definition of Geospace. Two main forms of spatial information was considered. We discussed the dataset of geospace model. This paper shows Siberian State University of GeoSystems and Technologies conducts research in the field of photogrammetric data processing for geospace model. For this purpose selected digital photogrammetric system PHOTOMOD (Company Racurs, Moscow) and Photoscan Professional software, (company Agisoft LLC, St. Petersburg). The aerial imagery of one aerial route 1: 6,000 scale for photogrammetrically processing are used. In digital photogrammetric system PHOTOMOD tested the following acquisition modes vector layers: without classifier, with user classifier and classifier of GIS Panorama. By Means of Agisoft'sPhotoscan Professional software was obtained Digital Surface Model (point cloud). Also the accuracy assessment of results was made.

Key words: geospace model, technology, digital topographic plan, 3D video scene, digital elevation model (DEM), digital object model (DOM), digital photogrammetric station (DPS), 3D GIS.

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MAPPING THE BASIS OF CADASTRE: HISTORY, OBJECTIVES AND REQUIREMENTS

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The article is devoted to the history of the cartographic base inventory since the inception of the State Land Cadastre in the USSR and to the present. It is noted that the cartographic basis of the state cadastre of real estate began to develop in 1978 the forces of the All-Union Institute of Agricultural research aerogeodetic (VISHAGI). The article is a systematic set of objectives and requirements for the cartographic basis of the inventory arising over the entire study period. Tasks application cartographic basis are grouped into the following objectives: maintaining the real estate cadastre, formation of land plots and land, state land supervision (control), the state land monitoring, state cadastral valuation. The suggestions on the need for uniform requirements for cartographic basis for a variety of purposes, and the transition to a unified electronic cartographic base (EEKO).

Key words: cartographic basis, orthophoto, land cadastre, real estate cadastre, cadastral map, cadastral registration authority.

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PROTOTYPING MULTI-AGENT SYSTEMS MONITOR THE STATUS OF MAN-MADE OBJECTS

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In the present article the possibility of developing a multi-agent system to determine the status of man-made object. The scheme of the multi-agent system. The structural units of the multi-system: data acquisition unit that provides collection, storage, data transmission and information on the condition of man-made objects; intelligence unit, providing an analysis of the incoming data;

block user interaction, providing the user with all the necessary information about the object. The main intelligent agents necessary for the operation of multi-agent systems: subordinators agent, the agent integrator, implementing agents, agents communication. Consider the enlarged structure of a typical intelligent agent and highlights its main characteristics. A prototype system multagentnoy. An example of the first cycle of the system to determine the space-time state of man-made object. The mathematical algorithm for determining the space-time state of the object and move the boundaries of the "safe" in the "dangerous" state in the phase space.

Key words: space-time state of the object, multi-agent system, intelligent agents, man-made objects, the interaction of agents, data analysis, decision-making.

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FOREIGN EXPERIENCE IN THE FIELD OF CARTOGRAPHIC GENERALIZATION OF THREE-DIMENSIONAL MODELS OF URBAN AREAS

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This article discusses some features of the generalization of three-dimensional models of urban areas. International developments in the field of generalization of the three-dimensional terrain models and perspective maps are briefly described. Attention is paid to the solution of one of the most important tasks of generalization, relating to facilitate the perception of spatial information for a quick orientation on the ground using a map. Some ways of improving the perception of the topological structure of the city and reduce invisible areas on a perspective maps are described. In particular, it briefly described the method of synthesis of the cell-based simplification of the topological structure of the urban area and the method of creating a progressive and regressive perspective is reviewed. The article also referred to a raster based approach to three-dimensional generalization, which consists in the analysis and simplify planned projections of three-dimensional objects of the urban area. At the end of the article there are links to the work of the Siberian state University of geosystems and technologies in the field of three-dimensional mapping.

Key words: generalization, detalization, perspective map, synthesis, structure, three-dimensional digital model, urban area.

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TESTING OF SOFTWARE PRODUCTS BY DEFINITION OF MAGNETIC DECLINATION

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Performed analysis of existing software for determining magnetic declination, based on different models of the geomagnetic field for their application in spatial orientation of boreholes. Proposed the technique of determining magnetic declination geodetic method. Estimated the accurate determining of the values of magnetic declination with the proposed method. Compared the values of magnetic declination obtained with magnetic calculators, it is based on models of geomagnetic field of the Earth, and is measured with a theodolite with a landmark-circumferentor on the reference basis. It is established that the discrepancy between the calculated and measured instrumental values of magnetic declination is acceptable in terms of accuracy for determining the orientation of boreholes. Identified deficiency in the design landmark-circumferentor, and formulated proposals for improving the design landmark-circumferentor to improve the accuracy of measurements.

Key words: magnetic declination, oil and gas field, orientation of the borehole, theodolite, circumferentor, analysis of software products, geomagnetic field.

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POSITIONING TECHNOLOGIES IN REAL TIME

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Currently, there are many tools to solve the problem of determining the position in space of a physical object. The use of positioning systems of people and material objects - one of the important ways to improve technology and business processes in various fields of activity. The main differences today existing systems is: the scale of the territories in which the possibility of their work in the precision with which the location of the definition required for the operation of the system resources. In addition, there are some limitations on the use of technology according to the object localization.

This article provides a brief overview of positioning technologies are listed and analyzed the most common methods of determining the location of objects identified important criteria for their assessment, are the main technical characteristics. The article also presents a model of determining the coordinates of moving objects in a certain local area with high positioning accuracy.

Key words: RTLS, RF technology, satellite navigation technology, local positioning technology, infrared positioning, ultrasonic positioning, RFID tags.

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LAND MANAGEMENT, CADASTRE AND LAND MONITORING

THE MODELS OF FORESTS LANDS AS A BASIC UNITS OF GIS MONITORING IN LAND USE

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In article questions of mathematical model's formation of forest's lands as a basic units of GIS monitoring in land use are considered. Such models are presented in forms of natural objects (forest's resources), a natural phenomena (create an environmental and social functions) and natural processes (nature-, land-, and forest-creating). Concrete parameters of a function of forest lands (forests) are specified in maintenance of composition of atmospheric air in intensively developed territories of the Urals and parameters of the water-preserving and water-regulating functions of the foresting and water-collecting territories given many-year's transformation. Models of forest-creating's processes given the spatial and temporal dynamics are presented. Considered models of forest lands in the basic blocks of geoinformation systems of monitoring in land use allow to introduce a time scale by which the prediction of land condition. It creates a unified geographic information system for monitoring of forest land, providing forecasted estimates of the impacts of various land use options taking into account modern challenges and risks.

Key words: forest's lands, information systems of monitoring, simulation models, basic units, natural objects, natural phenomena, natural processes.

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REVISITING THE ROLE OF THE SPECIALIST AND THE EXPERT IN INTEGRATED STATE REAL ESTATE REGISTER ERRORS DISPUTE IN CIVIL PROCESSES

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Enactment of the new estate property law causes the new legal precedents since 2017. The issue is civil process related to errors in Integrated State Real Estate Register (ISRER). These juridical contests are about technical errors and registry-based errors. Persons participating in civil case may attract professionals and experts in averment. In some cases it is not need to attract them. These persons` goal is to pass an opinion of the person participating in civil case questions. The cadastral engineer statuses as the professional and as the expert are discussed in this article. Cadastral engineer must follow professional conduct rules of self-regulated organization which he belongs to. Passing an opinion of the cadastral engineer should not contradict such professional conduct rules. At the same time the expert report may have a criticism of another cadastral engineer. Authors of the article discuss if a cadastral engineer may be the professional or the expert in civil process.

Key words: errors in Integrated State Real Estate Register, technical error, registry-based error, land surveying expert report, cadastral engineer.

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SOIL FERTILITY MONITORING OF AGRICULTURAL PURPOSE LANDS AS A MECHANISM OF THEIR RATIONAL USE

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Rational use of land, including agricultural one is the main objective of land policy, carried out on the basis of the implementation of such legal functions such as planning and land zoning, distribution, redistribution, control the proper use of state. Information support of such processes involves carrying out land management and land monitoring, cadastre, registration of legal rights ensuring accurate identification of land parcels, fixing their consumer qualities, purpose and actual use, legal status and limit economic assessment as the objects of taxation. The most important characteristic of agricultural land is fertility, accumulating soil quality, climate and the impact of technology largely determining the state of agricultural production and food security of the country, and, therefore, requiring constant monitoring of the level of rational use of plow lands and forage lands of the most advanced agricultural technologies. In this context, it discusses the modern paradigm Biosaline Agriculture, which provides records management principles fertility of soils, plant productivity and sustainability of agroecosystems. A more complex concept, defining the content and the required level of soil fertility, requires more reasonable tools for its monitoring, and actually - a special geoinformation support of the design, creation and monitoring of agrolandscape farming systems.

Key words: agroecosystem, agrolandscape, soil, agricultural lands, biofarming, rational land use, geoinformational support, monitoring, land management.

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APPLICATION OF THE DEVELOPED SOFTWARE MODULES OF THE AUTOMATED WORKPLACES OF CADASTRAL ENGINEER IN THE KHANTY-UGRA

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In this article the automated control system for data applied in activities of the cadastral engineer is considered. The technique of actions of obtaining inventory data by means of systems of automation of processes of technological operations is given in program and technical tools of guiding of such operations. Operation in instrumental GIS of an automated control system of cadastral activities which is concluded in data handling of shootings, measurement operations for the purpose of establishment of boundaries on a cadastral card is shown. The diagram of algorithms of the main operations in the instrumental application program GIS - «MapInfo Professional» is provided. The structure of the automated system directed to obtaining cadastral documentation in the form of an interface prototype in a software environment is set. The conclusion is drawn that the result of activities of operation in the program creates the database with spatial and semantic filling of inventory data.

Key words: cadastral engineer, cadastral activity, systems of automation, automated control systems, GIS, land information system, cadastral documentation.

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OPTICS, OPTICAL AND ELECTRONIC DEVICES AND COMPLEXES

ABOUT THE POSSIBLE MECHANISM OF FORMTION OF COMPLEX CRATERS

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At studying the form of craters on a surface of the Moon it was revealed, that sometimes at the bottom of flat craters precisely expressed hill is observed. It has been come out with the assumption of dependence of the form of a crater from the form of a meteorite and research of this assumption in the form of computing experiment is made. Studying of impact of superfast bodies with a barrier, has shown, existence of many forms of craters depending on the form drummer - a meteorite, its speed and gasdynamic characteristics, physical properties of a barrier. Including: occurrence откола in the form of a return cumulative jet for drummer with density below density of a barrier, existence of flat craters with hills inside, occurrence during impact of emptiness inside of hills of a barrier, creation during impact of cylindrical craters - wells.

Key words: crater, meteorite, impact, computing experiment, cumulative jet, target.

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MODELING OF THE MICROMECHANICAL OPTIC GRATING LIGHT VALVE DYNAMIC RESPONSE

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In this paper the modeling results of the microbeam moving process under control voltage are presented. Transient relations between microbeam deflection and parameters of the external electrical signal such as magnitude and rising and falling edges in wide wavelength range are shows. Design and manufacturing process of the diffraction grating light valve perspective for telecommunications are considered. Digital and analog device modes are described. Modeling results in ANSYS demonstrate the ability to achieve modulation frequencies of 0,5–0,6 MHz for optical signal with 1600 nm wavelength as well as visible range.

Key words: MOEMS, diffraction grating light valve, modeling, ANSYS.

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THE POSSIBILITY OF NANOOBJECTS PARAMETERS RESEARCH BY ATOMIC EMISSION SPECTRA, INDUCED BY LASER PULSES ON SURFACE OF TOTAL INTERNAL REFLECTION

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About preliminary experimental research of conditions for obtaining laser plasma, induced in layer of nanoparticles on surface of total internal reflection is reported. The research is directed to creation of a technique of atomic emission spectra analysis of the nanoparticles placed on a surface of transparent substrates, the problem of pollution of analyzed nanoparticles spectrum by a substrate material spectrum is solved by means of irradiation from the substrate side of a surface with nanoparticles with laser irradiation at an angle of total internal reflection when the substrate remains cold. It is shown that the irradiation of a single laser pulse with duration 5 ns, the radiation wavelength 532 nm, pulse power $12 \cdot 10^6$ W radiation intensity is sufficient for transfer of nickel nanoparticles with dimensions 80 nm in the state of atomic vapor.

Key words: atomic emission spectroscopy, atomic emission spectrum, nanoparticles, surface monolayer, total internal reflection, optical tunneling, laser plasma.

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METHOD ADEQUATE MEASUREMENT OF S-PARAMETERS OF ACTIVE MICROWAVE QUADRUPOLE ANALYZER IMPLEMENTS IT

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In the article the principle of the simulator-analyzer, which provides simulation of microwave amplifiers and oscillators in a coaxial of meter tract in accordance with their terms of reference and then measuring the com-plex loads reflection coefficient of the active ingredient of these devices for the subsequent design in microstrip design. The patient was discharged mathematical model simulator analyzer, as well as its mathematical model calibration. In addition, we consider a method of analysis of the active ingredient stability in the space of his loads complex reflection coefficient, which facilitates the selection of these loads and the most active component in simulations of amplifiers and oscillators. In addition, the possibility of using the simulator analyzer for the measurement of the complex reflection coefficient at the input and output of the loaded active ingredient, as well as measuring its complex transmission coefficients, which together with the measured complex coefficients it loads reflection enable the proposed method to determine the S-parameters of the component, which he I would have when incorporated in a microstrip line.

Key words: Simulator Analyzer, active four-poles microwave, mathematical model, calibration, complex reflection coefficients and transmission, S-parameters, an adequate measurement of S-parameters, amplifiers, oscillators.

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