A NEW PROCEDURE FOR EXACT JOINT ADJUSTMENT OF THE THREE DIMENSIONAL NETWORK IN THE LARGE AREAS

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ABSTRACT

Geodetic measurements in three dimensions are common, but were historically performed in two separate components – the height and the position. This separation has originated from used methods, the predominant method of height difference determination was levelling, and position was determined by the angle and distance measurement. Also points were stabilized differently. A longer time in the field of engineering geodesy are used procedures for determining of the coordinates and derived variables based on the total station measurement, and therefore on the simultaneous measurement of the horizontal directions, zenith angles and slope distances. The adjustment of the three-dimensional network is then often used and the procedure is well known, but it can be used with some fundamental limitations. Measured values must be reduced from instrument and target height to point with use of the deflection of the vertical. On small areas the network can be adjusted without any reductions, as in Cartesian coordinate system. On larger areas the measured distances must be reduced to sea level and to the reference surface for the positional coordinates' calculations, but not for the heights calculation. Existing solution calculates separately positional component (X, Y coordinates) and heights (H), although height differences are calculated from measured zenith angles and slope distances and are correlated with X, Y coordinates. A new solution allowing exact joint adjustment of the three dimensional coordinates is proposed in the paper, a procedure can be used on the large or long building sites without any limitations, points of the network can be also in quite different heights and the reduction to reference surface can be also different for each point.

Keywords: adjustment of geodetic networks, measurement reduction, large building site

ACHIEVEMENT OF DECIMETER LEVEL POSITIONING ACCURACY WITH SiRFstarIII GPS RECEIVERS

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ABSTRACT

Nowadays most of mobile devices are equipped with microcontrollers enabling to receive GPS signals. The most popular of them is a single frequency SiRFstarIII module which allows communication using two data formats: NMEA and SiRF Binary Protocol. These formats are used to output raw measurement data, such as pseudoranges, phase measurements, carrier frequency, clock bias, etc. Unfortunately, access to the carrier-phase is blocked and, in consequence, obtaining a high positioning accuracy using methods based on phase measurements, such as RTK, is impossible. The paper explains how to solve this problem by reconstruction of missing carrier phase observables from integrated carrier frequency measurements. Presented solution gives a possibility to obtain decimeter level positioning accuracy by SiRFstarIII GPS receiver using the RTK method. The obtained results prove possibility of using such receivers in professional geodetic applications e.g. for GIS purposes.

Keywords: GPS, RTK, SiRFstarIII

ACHIEVING THE TOPOGRAPHICAL WORKS NECESSARY TO ESTABLISH A POULTRY FARM

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ABSTRACT

The paper purpose consist in computing the surfaces, the heights for the existing and future planimetric details, for a poultry farm as stipulated in Jimbolia PUG and tracking its suitability in the actual European Standards by precise topographical works.

Jimbolia city is situated in the lower Banat plains, in the West side of Timis County, more accurate in the Torontal Plain, represented by an association of low fields formed by Timis, Tisa, Bega, Barzava and Nera river. Jimbolia city stretches on a total surface of 10,818.23 ha having as West neighborhood Serbia.

The location of poultry farm is at the Jimbolia city boundary, along the national road DN 59A, at 43 Km distance from Timisoara, city residence of Timis county.

The paper basis consist in the topographical works necessary to establish a family poultry farm achieved by rural development projects, the 121 step and executing the necessary stake out works for building the foundations, executed in Jimbolia, Timis county.

This project is destinated for building a hall which purpose is to raise and product poultry products, by making available technical and legal information regarding geodetically works.

In this work, the influence and the application of engineering topography in cadastre and in construction field of activity, regarding modern approaches for increasing the precision of the stake out works by using spatial technologies as GPS type combined with total stations has been studied.

For the implementation of the main pavilion the processing of the field data determined by GPS, by RTK method was necessary in order to achieve the situation plan that later on is use by an architect for obtain the necessary approval and processing the specialized data.

Later, after obtaining the necessary approval, after obtaining the construction license, the stake out elements calculation was performed by polar coordinates method.

The paper also discusses how the fieldwork is use for stake out the angular and linear elements that define the planimetric position of points and zero level of the construction.

Keywords: poultry farm, stake out plan, RTK

ADVANTAGES OF USING IT SOLUTIONS IN LAND SURVEYING AND CADASTRAL PROJECT MANAGEMENT

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ABSTRACT

The level of project management maturity level highlights are applied in enterprises, specific project management principles in work measurement and cadastral land. One of the factors which contribute to achieving a high level of maturity in project management is the use of project management information solutions. Application of the time domain through them leads to projects that can be implemented and monitored easily. Through this article we aim to highlight areas where further reveals the utility of using such software. Projects in general and especially projects in the domain of land surveying, in particular, require a careful planning in the implementation phase to achieve a successful overall implementation. In order to improve this situation, we believe that using of IT solutions for dedicated management is mandatory.

Keywords: cadastral project, land surveying project, Microsoft Project, maturity level

ANALYSIS OF LONG TIME SERIES OF TROPOSPHERIC PARAMETERS DERIVED FROM GPS DATA PROCESSING

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ABSTRACT

Very high quality of tropospheric delays determination on the basis of data from GPS (Global Positioning System) permanent stations allows to investigate them for the benefits of various economic and scientific areas. The paper presents results of the analysis of ZTD (Zenith Tropospheric Delay) time series resulted from the EPN (EUREF Permanent Network) reprocessing performed by the Military University of Technology. Through the homogenous strategy used for the whole period of processing (since 1996 to 2011, but the length of time series depends on the particular station), the final precision of ZTD values is estimated to be at the level of 2-3 millimeters. In addition, EPN station are equipped with meteorological sensors, so time series of IWV (Integrated Water Vapour) were also determined for the exemplary station MATE (only few EPN stations have long observation history concerning meteorological data). Time series of these parameters were analyzed in order to find short- and long-term trends which could be associated with the meteorological conditions and climate change. In particular linear trend and seasonal components (annual and semi-annual) were estimated on the basis of IWV time series using Least Squares Estimation (LSE).

Keywords: GPS processing, troposphere, ZTD, IWV, time series.

ANALYSIS OF POSSIBILITIES TO APPLY LASER SCANNING TECHNOLOGY IN INVESTIGATIONS OF INDUSTRIAL OBJECTS

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ABSTRACT

Projection of appearance and geometry of complicated industrial objects is a complex task, which requires that appropriately scheduled and prepared measurements are performed. Such objects must be accurately inventoried, but their complicated shapes often makes the access to such objects and visibility of their entire surface very difficult. Prepared documentation was often developed in the form of sketches, plans or maps, which were additionally amended by photographic documentation. Visualisation of objects in such a form is often insufficient. Due to the increasing number of industrial objects, as well as technological development, the need to modify methods of inventorying has appeared. Designing of new elements with the use of CAD/CAM tools requires that an object is described in three dimensions. Measurements were initially performed with the use of tacheometers, allowing for obtaining spatial co-ordinates of each point. Such technique required the utilisation of a mirror and involvement of the second person. Zones which are excluded from the possibility of visits by humans often exist within the areas of industrial objects. That is why mirror-less total stations appeared in the market, which allow for contact free measurements. However, measurements lasted too long and they were not cost effective. Basing on this technology a laser scanner was constructed. It automatically measures millions of points [5] and operates much faster than a total station.

The terrestrial laser scanning technology produces a three-dimensional description of geometry of scanned objects. The accuracy of measurements performed by the scanner does not differ from the accuracy of measurements performed by precise tacheometers and the speed of measurements reaches about o million of points per second. Integration of laser scanning and digital images allows for creation of a realistic 3D model. Data acquired by means of the laser scanner may serve for inventorying complex industrial objects and for valuable analyses, which could not be performed using conventional techniques. Operating the "cloud of points" includes realistic visualisation and precise measurements in a space transformed to the virtual reality and it is the basis for advanced spatial modelling and reverse engineering [2].

Keywords: terrestrial laser scanning, conditions of industrial objects, modelling industrial elements, deformation of tanks, piping modeling, point cloud

ANALYSIS OF SPATIAL DISTRIBUTION OF GEODETIC CONTROL POINTS AND LAND COVER

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ABSTRACT

The article presents results of the analysis of spatial distribution of third order of geodetic control points with reference to land cover. The results are referred to regular 200 m grid. Grid cells attributed by number of geodetic control points, dominated land cover type, and high above sea level were classified by k-means algorithm in 4 clusters. The choice of optimal clusters number has been preceded by the V-fold cross-validation test. The outcomes are presented as choropleth map. Particular clusters of grids type have been assigned to specific colour increasing in value in accordance with density of control points and degree of compliance with the requirements of Polish regulations. Conducted study indicates that number of geodetic control points which are located on particular area depend on type of land cover and topography (in 50%). Taking into consideration the results authors recommend that diversification of land cover should be accommodated during network layout.

Keywords: geodetic control, land cover, spatial analysis, spatial statistics, k-means clustering

ANALYSIS OF THE IMPACT PROCESSES OF CLEARING WORKS ON THE CHANGE OF THE STRESS-STRAIN STATE IN THE PRIMARY AND DEPOSITS RE-MINING

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ABSTRACT

Extensive size and presence in bowels numerous mineral deposits made the Kazakhstan one of the leading mining countries. Large deposits and mining which started back in the 20th century, at the present stage mining experience some difficulties, because exhausted by far their main balance reserves. Today on such deposits is a revision going of reserves in content transfer off-balance inventories to balance active and develop reserves left in difficult geological conditions (increase in depth development zone flexures, multiple overlapping, etc.). As a result of this re- development is the formation of a new force field of secondary stress, which can increase in the negative manifestations of rock pressure: the emergence of centers of mass collapse, subsidence in the development of planes overlap thicker high cost of maintaining the crumbling roadway, appearance - displacement trough depressions on the surface and violation of problems due to the formation of zones of ventilation collapse.

In this paper we analyzed the mining and geological documentation of the current state of mine workings on the stability and the results of field experiments, analyzed the influence of processes of clearing works on the change of the stress-strain state at the primary and re-working out, fitted changes depending on the load pillars in sequential excavation antechamber and barrier pillars, was determinate the causes of catastrophic rock pressure.

Keywords: stability of the developed space, technological collapse, mining structures, coving collapse, weakened areas, stress, movement of the earth surface, deformation, causes of collapse

APPLICATION OF ROBUST ESTIMATION METHODS TO CALCULATION OF GEOMETRIC DISTORTIONS OF A COOLING TOWER SHELL

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ABSTRACT

The proper assessment of a structure's safety requires reliable information on geometric shape of the structure in question. Geodetic measurements are the source of data about the actual shape of the object. Depending on the technology of measurement, the data gathered are at different level of detail rendering, accuracy and time necessary to collect them. Hyperboloid cooling towers are among the most important structures that require periodic inspection. These reinforced concrete structures are very popular in conventional power engineering. The purpose of the periodic measurements of these objects is to determine the geometric distortions of the cooling tower shell. Geometric distortions are defined as deviations between the facility's actual shape measured with the use of geodetic methods and its theoretical geometry. The least square method is the most popular method to determine geometric distortions. Although has numerous advantages, this method shows poor resistance to the presence of the survey points that distort the normal distribution of the data collected. This paper presents robust estimation methods as one of the options to do that. Distortion values obtained in this way are resistant to the influence of outliers and are more reliable. The results of calculations presented in this paper were obtained for the cooling tower located in the western part of Poland. Geodetic measurements for that structure were made independently, using total station and terrestrial laser scanner. Having done so, an additional objective of the study could have been accomplished, which was to show the influence of the measurement methods on the results of calculations of geometric distortions of the cooling tower shell under study.

Keywords: cooling tower, geometric distortions, robust estimation, terrestrial laser scanning, total station

APPLICATION OF TERRESTRIAL PHOTOGRAMMETRY TO CREATE A SPATIAL MODEL OF THE CHAPEL OF SAINT ANTHONY OF PADUA IN KOBEŘICE, CZECH REPUBLIC

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ABSTRACT

The aim of this article is to briefly describe the procedure for creating a three-dimensional model using a commercially available digital camera. It describes camera calibration, image analysis and procedures employed to create a 3D model. The result of the project will be a 3D model of the object which will be processed in the PhotoModeler program. This model can then be inserted into the Google Maps application or it can be used to visualize the 3D position of the object.

Keywords: 3D model, camera calibration, image analysis

ASSESSMENT OF SUITABILITY OF TERRESTRIAL LASER SCANNING FOR DETERMINING HORIZONTAL DISPLACEMENTS OF COFFERDAM DURING MODERNIZATION WORKS ON THE REDZIN SLUICE

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ABSTRACT

In recent years the use of terrestrial laser scanning has become wider in engineering geodesy. At the same time, the accuracy of laser scanners has increased significantly. The author found it worth considering, however, if the scanner accuracy is sufficient for precise measurements of the displacement of engineering structures. It is not without significance what type of structure is subject to analysis and what are the conditions in which the survey is being performed.

This paper presents the assessment of suitability of terrestrial laser scanning for determining horizontal displacement of the cofferdam structure. The particular cofferdam included in this case study was made of sheet pile walls to serve as a temporary partition during the modernization works on the Rędzin sluice, located on the Oder River in the south-western part of Poland. In the research phase, an initial survey and a few periodic surveys were performed. The measurements of the cofferdam's horizontal displacements were taken on non-stabilized instrument stations in relation to external reference points. Most of the scanner measurements were carried out in challenging conditions, e.g. unfavorable angles of the laser beam reflection, wet and rusty surface of the sheet pile wall, or a large number of obstacles which cast shadow on the cloud of points. For the purpose of research, independent surveys of horizontal displacement values were made using a high-precision motorized total station. The least squares method was used in order to process the data collected through survey. Subsequently, the results obtained both from the scanner and from the total station were compared. The analysis included the position of the check points at different times of the survey, after which the deviation of the values of horizontal displacement could be determined. On that basis, it was possible to make an assessment of the scanner accuracy for displacement measurements. The final part of the paper summarizes the results, and the conclusions take the form of several recommendations useful in the engineering practice.

Keywords: sluice, terrestrial laser scanning, total station, horizontal displacements

AUTOMATION OF TESTING OF GEODETIC MEASURING INSTRUMENTS

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ABSTRACT

International and national standards for testing and calibration of geodetic measuring instruments specify the procedures of testing and calibration, as well as the presentation of measurements results with the estimation of measuring uncertainty. The paper presents only the international standards for testing and calibration of geodetic measuring instruments because the national standards are identical to original international standards. The paper includes the automation procedures of testing the precision of the following geodetic measuring instruments: levels according to the standard ISO 17123-2:2001, theodolites according to ISO 17123-3:2001, and GNSS RTK measuring system according to ISO 17123-8:2007. For the purpose of automating the testing of the precision of geodetic measuring instruments according to the above mentioned standards, the computer programme *GeodISO* has been prepared, using modern programme language C#. This programme provides the processing of measurement data, the performance of adequate statistical tests and the preparation of test reports.

Keywords: automation, precision, geodetic measuring instruments, programme language C#, GeodISO.

AVAILABILITY CHARACTERISTICS DETERMINATION OF FKP AND VRS TECHNIQUES OF ASG-EUPOS SYSTEM

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ABSTRACT

Network-based ASG-EUPOS reference ground stations system, known as the Polish Active Geodetic Network, has been in operation since 2008. NAWGEO is ASG-EUPOS service and it provides differential corrections for Real Time Kinematic (RTK) method of positioning. In this publication FKP (in German: Flächen−Korrektur−Parameter) and VRS (Virtual Reference Station) techniques were used for the availability characteristics analysis for DGPS/RTK methods of positioning. This characteristics were determined by using semi-Markov processes. Two dual-frequency Ashtech Z-Extreme GPS receivers were used for DGPS/RTK methods via GPRS teletransmission data system. About 1.5 million point coordinates were collected. This data were gathered with 1 second interval. A few accuracy thresholds for semi-Markov processes were arbitrary chosen. The results were compared and presented in this publication. On the basis of the performed tests it is shown that the VRS technique is better than FKP technique.

Keywords: Availability characteristics, semi-Markov processes, DGPS, RTK

AVOIDING LOSS OF HERITAGE BUILDINGS USING LASER SCANNING TECHNOLOGY

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ABSTRACT

Subject to constant pressure due to explosive growth in recent years, historical monuments have had and continue to suffer.
Protecting cultural heritage requires research, study, interpretation and presentation, in order to find the optimal formula of his appreciation and recognition to the contribution of social inclusion level. Therefore, there are necessary preventive measures and implementation of damage control solutions on cultural heritage.
Many heritage buildings in Bucharest are in an advanced state of decay. For this reason the paper purpose is to use laser scanning technique for preserving heritage buildings. This technique is an effective method of restoring of the old buildings with high accuracy and precision for performing various conservation works.
The advantages are that the investigation is non-invasive, rapid, precise and environmentally friendly.

Keywords: scanner, laser, cultural heritage

CALCULATE THE VOLUME OF LANDFILL CRISTEŞTI, MUREŞ USING THE CLASSICAL METHOD AND DIGITAL TERRAIN MODEL USING PICTURES FROM UAV

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ABSTRACT

In this paper we intend to investigate the development of the landfill Cristesti because it occupies a large area and it's dimension are growing every year and it is placed very close to the town with the same name Cristesti, for the inhabitants creating an unpleasant environment to live in, despite the toxic air being emanated. For this we use two methods: One of this is the classical measurement with the GPS and the second method uses the tehnology of UAV (Unmanned Aerial Vehicle), method based on photogrammetry, geodesy and GIS theories. After that we will process the data to get the pit area and volume using both methods and compare accuracy results, to test the plane abilities and show that this is a more suitable method for geodesy work. We will use the Agisoft PhotoScan software for proccessing the data, taken by the UAV's onboard photographic camera, that means joining all photos in a single one, according to the marks at known groung locations resulting in a ortophotoplan and a 3D model of the terrain both used to measure the surface and volume of landfill. The volume is obtained from the altitude difference, since the plane will fly at two different altitudes. For the established GPS version the method will be "STOP and GO" and the processing soft will be AutoCAD. This was possible with the help of TeamNet which have provided a contest "THINK'N'DO – Eye in the sky", to find a viable applicability for this drone, they liked our idea and they gave us a price for our work to use the UAV's tehnology.

Keywords: UAV technology, landfill, surveying and measurement, surveying applications, Romania, topography.

CLOSE RANGE SURVEYING WITH NIR HANDHELD SCANNER

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ABSTRACT

Structured light scanner where rather not at field of interest of surveyors. Not because of accuracy of this technique which is far away before classic surveyor expectation, but because of limitation related with range and very low mobility. Also long time of data acquisition and processing was also a problem not acceptable from surveyors point of view. But at 2012 a new device was released called F5-MVP from Israel Company Mantis Vision Ltd. Product was created as a result of Israel military order for fast, precise and high mobility device for close range 3mapping. This article shows results of using F5-MVP scanner for close range surveying.

Keywords: 3d scanning, 3dmapping, survey

CLUSTER ANALYSIS OF LAND PROPERTIES FOR THE PURPOSE OF MASS APPRAISAL

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ABSTRACT

The aim of this research was application of data clustering, especially k-means clustering algorithm, used for grouping land property for the purpose of elaborating tax map. Morphometric characteristics such as parcel's size, parcel's shape, area, and type of land use have been used as exogenous variables whereas transaction price per 1 square meter was adopted as endogenous variable. Since the classification result (k-means method of classification) depends on assumed a priori number of class therefore to estimate number of clusters both, agglomeration method and Ward's algorithm have been used. Land properties grouping has been done for Stoczek Lukowski municipality, located in south-west part of Poland. Data for analysis were taken from lands and buildings register and from registry of real estate prices and values. Due to the fact that real estate prices were prices of the years 2002-2012 in the preliminary stage of the study they were updated using multi-linear regression method. Land average transaction price for real estates of each group is similar, this made mapping of the property value possible. Such map is a decent source of information for both, investors and local government responsible for the management of a municipality area in a sustainable way.
Keywords: grouping properties, land value map, mass appraisal

CREATION OF THE STAKING-OUT NETWORK AND SETTING OUT OF THE SPRINKLER'S TANK

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ABSTRACT

In this article is described process of the staking-out network creation which was used for building of the shopping center in cadastral unit Pražské Předměstí, city of Hradec Králové, Czech Republic.

Creation of the staking-out network is described in theoretical bases then used equipment and software, point benchmarking, methods and procedures. In the article you can also find network connection to the positional and levelling reference system as well as network adjustment. Every part of the work is done according to the statutory and rules valid in Czech Republic.

Final part describes practical use of the staking-out network for project transfering in situ. Namely for setting out of the Sprinkler´s tank which serves for emergency reserves of the fire water in shopping centers, logistic centers and industrial areas.

Keywords: staking-out network, positional connection, height connection, Sprinkler's tank

CULTURAL HERITAGE CONSERVING USING TERRESTRIAL LASER SCANNING TECHNOLOGY

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ABSTRACT

Nowadays, various society fields demand realistic 3D models used in the areas of analysis, design, verification, rapid prototyping, and updating of other existing CAD models. Also, 3D models are used in the entertainment, museum and power generation industry.

Using Terrestrial Laser Scanning technology the scientists have the opportunity to study and document the engravings or small structures in the sites, to compare sites on different locations and also to make the archeological site virtual reconstruction.

The application presented in this paper consists in 3D mapping of the environmental processes like human made environmental changes in our case, in order to produce the 3D model of the Garden of Medieval Ruins in the historical downtown of Szekesfehervar. The final model can be used in a variety of fields such as topography, archaeology, architecture and landscape architecture.

Keywords: Laser Scanning, 3D model, cultural heritage

DATA PROCESSING FROM A LOCAL NETWORK GPS-MEASUREMENTS AND REMOTE SENSING AROUND THE CITY ALMATY

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ABSTRACT

Laboratory of geodynamics in the "Institute of Ionosphere" actively pursuing researches of the earth surface movements, geological, geophysical and geodynamic features of the structure of the crust and lithosphere in seismic regions, and conducts continuous monitoring due to dramatically impact of the cut on top of soil as a result of intensive constructions and medium altitude objects. The new approaches were used to the analysis of the strength and stability of the "soil-structure" system. High-rise building creates a lot of stress, penetrating to the depth and covering large volumes of soil. Daylight weak and watered soils limit state leads to the accumulation of irreversible deformation and, as a consequence, significant precipitation of the building. As a result of heterogeneous distribution of strains cause dangerous slopes instability for tall buildings.

From the standpoint of the need for setting geodynamics work is dictated by the fact that Almaty is located in the submontane trough between the Kazakh Shield to the north and orogens of Northern Tien Shan . Submontane trough is part of the trough base of the crust and currently continues to be formed. Consequence of this process is a network of faults, traceable and within the city boundaries. Displacement amplitude for some of them is reaching hundreds of meters. Thus, a network of young major faults can significantly determine the strain distribution in the thickness of the crust within the city boundaries.

Keywords: geodynamics, seismicity, Earth's crust, ground base, GPS measurements, radar interferometry.

DEALING WITH THE IMPACTS OF ORIGINAL LAND SURVEY INPUT MATERIALS IN MAPPING IN THE HLUČÍN DISTRICT

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ABSTRACT

The aim of this paper is to briefly describe the problems encountered when mapping in the Hlučín district, where the so called Prussian Cadastre had been used for a long time. The problem will be illustrated by briefly describing the procedure deployed when analysing the results of land surveys in a concrete part of the Hlučín district – namely the cadastral territory of Strahovice. The paper deals with the procedure used when assessingthe impacts of accuracy of the original geometric bases on the resultant map, and suggests one of the possible solutions to identify the sources of errors, allowing the subsequent measurements to be made more accurate.

Keywords: Hlučín district, mapping in the Hlučín district, measurement analysis

DEFORMATION ANALYSIS OF THE ROOF COVERINGS USING THE SURFACE MODELING TOOLS

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ABSTRACT

Nowadays, more and more buildings are being built with complicated shapes and uncommon roof coverings. Modern structural solutions require also usage of advanced methods for analysis and tests of building objects. Among many measurement techniques, which allow us to acquire an object in 3D, terrestrial laser scanning should be mentioned. However, there are some tools available, like functions of spatial systems or CAD system, which also allow us to present objects in three-dimensional space from data obtained by applying conventional measurements.

The main aim of this paper is to discuss issues related to the surface modeling by using AutoCAD Civil 3D or ArcGIS 3D with the Analyst overlay. The authors present the scheme of using the advanced program functions for the analysis and visualization of deformation roof coverings of the building. The tests were conducted on several objects with various shapes of the roof coverings including dome and cylinder. Several methods of measuring and processing data were used. The analyzes of particular objects were performed on the basis of the results obtained. The usage of the specialized software enables us to extend the possible interpretations of the obtained results three-dimensional displacements.

Keywords: roof coverings, surface modeling, deformation measurement, visualization 3D

DETERMINATION OF BUSHING VERTICALITY FOR LOADING TESTS IN THE PAVILION OF TESTING FAST

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ABSTRACT

The article describes procedure which was used for verticality determination of the bushings for loading tests in the pavilion of testing. This pavilion is newly built in VŠB-TU Ostrava, Faculty of Civil Engineering, as part of the Testing house of the building materials.

The requirement of the building investor was to determine the verticality of the bushings placed between the first above-ground and the first underground floor. After the building finishing, the bushings with the diameter 70 mm will be used for loading tests of various building materials. The final number of bushings is 169, and they are placed lengthwise and crosswise in the step of 750 mm.

The centres of the bushings were measured by polar method in pavilion local coordinate system. The precision of the bushing centres determination was ± 5 mm according to the investor´s requirement. The precision would not be followed if the standard equipment for reflector fixing was used. In that case, it was necessary to design and manufacture special tool in the shape of truncated cone. On the top part was placed central pivot for reflector with additional plate bubble.

The calculation of the bushing centres was done in Groma software and graphically drawn in AutoCAD 2014. As a result, there is a CAD drawing with colour-distinguished top views of the bushings in the first above-ground floor as well as the first underground floor.

Keywords: Bushing, tool, polar method, CAD drawing

DETERMINATION OF DYNAMICAL POSITIONING ACCURACY CHARACTERISTICS OF MTI-G/MEMS MEASUREMENT UNIT USING ASG-EUPOS NAWGEO RTK SERVICE

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ABSTRACT

Inertial Navigation System (INS) integrated with Global Navigation Satellite System (GNSS) receiver is widely used for navigation purposes. In case of lack of GNSS signal a position of GNSS receiver is not computed and INS device can be utilised for a position computation. Moreover, INS device can use last known position obtained from GNSS receiver and navigation process can be performed with use of INS device. In this publication the accuracy tests of MEMS/GPS MTi-G device were performed on the moving car in various conditions of satellite visibility. The measurement results of this device were compared with the Real Time Kinematic (RTK) method positioning by using ASG-EUPOS NAWGEO RTK service in Poland. Measured points were collected by using 100Hz and 1 Hz interval for MTi-G and RTK Trimble SPS GNSS receiver, respectively. Synchronisation of the difference of UTC and GPS time was made. The RTK corrections were transmitted using NTRiP format via ASG-EUPOS Polish system of reference GNSS ground stations. RTK method was used for real-time determination of horizontal and vertical coordinates of the collected points. In this publication the accuracy characteristics of MEMS/GPS and RTK GNSS receiver are given. The coordinates obtained from MEMS/GPS measurement unit were compared to the fixed RTK points collected at the same time. Experiment was conducted by using a cabriolet car and the accuracy characteristics results are presented. The GNSS signals were cut off in MEMS/GPS measurement unit and the obtained coordinates were compared to the RTK fixed coordinates. The accuracy characteristics for these experiments are analysed. The results of performed analyses of accuracy are presented and drift characteristics of MEMS unit is determined.

Keywords: INS, MEMS, GNSS, RTK, ASG−EUPOS.

DETERMINATION OF POINT COORDINATES AND SYSTEMATIC ERRORS IN 3D GEODETIC NETWORK SOLUTION USING METHODS OF REFERENCE AND TRANSITION POINT INDICATORS

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ABSTRACT

A new algorithm for determining of the point coordinates and systematic distance errors in geodetic network solution is presented. Geodetic network solution should be understood as a system which consists of reference points, transition points, observations (distances), the systematic errors, and the unknown coordinates of the point to be determined. Transition point indicator definition is based on the reference point indicator definitions developed by the author. With the use of definitions of these point indicators, there is a solution for the sought point and systematic error in 3D geodetic network solution. The direct solution without application of the least squares method is derived. In the proposed solution there is no need to know the initial approximate location of the determined point, nor the coordinates of the transition points. In this article the basic principles of the methods for solving the positioning and systematic error determination problem in geodetic network are presented, and the formulas are given. The numerical example with simulated data confirm the correct performance of the proposed algorithm. The presented method should be further tested with real measurements in many domains of positioning and navigation as well.

Keywords: geodetic network solution, reference point indicator, transition point indicator

DETERMINATION OF POST-SEISMIC DECAYS FROM SELECTED GNSS AND SLR CO-LOCATED SITES

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ABSTRACT

The impact of earthquakes on the stability of time series on the selected GNSS and SLR co-located sites was investigated. After strong earthquakes and tsunamis many stations being the core of the ITRF (International Terrestrial Reference Frame) were affected by position discontinuities, which caused their temporal uselessness as the reference. As a consequence, the decrease of the quality of the network geometry also occurs. The Earth crust stresses and post-seismic relaxation damages occurring near the Earth surface can be mentioned as the main reasons of coordinates change. After the earthquake shape of time series can be described by curve line with dumping amplitudes (so-called "post-seismic decay"). GNSS and SLR data from selected co-located sites were processed to investigate the optimal method of post-seismic decays determination as well as the time necessary for each station to attain the stability again. It should be stressed that during that time, such stations should not be taken into account as a reference. The changes of North, East and Up components from co-located sites were described mathematically by fitting exponential and logarithmic functions in order to choose the optimal method for each case. Analysis of these functions can be interpreted twofold: it could reveal main direction of seismic wave propagation for geophysical studies and time which station needs to regain its stability in order of being included again as a referenced one can be determined.

Keywords: earthquake, post-seismic relaxation, GPS, SLR

DEVELOPMENT AND MONITORING OF A SUBSIDENCE TROUGH IN THE LOCALITY OF LAZY

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ABSTRACT

The paper focuses on the issues of subsidence formation as a function of the character of the rock massif and the extent of mining activities. The study was evoked by practical needs and as an attempt to deploy a simple method of observation by regular levelling of surface benchmarks. Classification of the actual surface damage is based on the difference between the measured values of surface subsidence and theoretical computations. The main method of observing surface changes were land survey techniques. The outcomes of this study of the development of a subsidence trough can be used in the planning of mining activities.

Keywords: mountain massif, settlement trough, underground mining.

DEVELOPMENT OF COORDINATES CONVERSION AND TRANSFORMATION STANDARDS FOR THE DANUBE WATER PROJECT

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ABSTRACT

Romania and Bulgaria started to develop in partnership a system of monitoring, warning and dissemination of data on the quality of environment in the border-area counties. The project it is achieved under the strategic project WATER - integrated water management and is financed under the Romania - Bulgaria Cross-border Cooperation Programme 2007-2013. The project goal it is to establish a common management and control system of the quality of the Danube waters under extreme conditions, caused by natural and technological disasters. The project area includes about 500 km on Romanian and Bulgarian common Danube border area. In order to implement the designed activities in the project area, one of the major infrastructure needed it is the geodetic network and based on that a geo-database including digital maps, specific data and metadata, GIS applications, et al. Along the history, from geodetic point of view, for different activities on the Danube (navigation, water level and quality monitoring, floods management) different kinds of Coordinate and Reference Systems (CRS) were used by Danube countries. For the Romanian-Bulgarian sector, an important issue of this project it is the establishment of a common CRS including horizontal and vertical position. Technical University of Civil Engineering Bucharest (TUCEB - Romania) and Executive Agency for Exploration and Maintenance of the Danube River (EAEMDR - Bulgaria) are the responsible partners for Activity 6 of the WATER project. The main goal of the Activity 6 it is to adopt and to implement a common CRS according to the European INSPIRE Directive. This paper presents geodetic research and applications performed on Activity 6 of the WATER project in order to establish coordinates conversion and transformation standards. The theoretical and practical implementation of horizontal CRS, named ETRS89 (European Terrestrial Reference System) and vertical CRS, named EVRS (European Vertical Reference System) are presented. Research on possible connections between these CRS and previous CRS (as Black Sea 1975 and Baltic Sea) are investigated. The final results of this activity can contribute to the modern realization of the most recent connection between the national geodetic networks of Romania and Bulgaria.

Keywords: WATER project (WP), geodetic network, coordinates, conversion and transformation, reference system

EFFECTS OF GEOLOGICAL FACTORS ON THE STABILITY OF LANDSLIDE PROCESSES

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ABSTRACT

In the recent years, increased attention is paid to monitoring of displacements and deformations of building structures, their construction parts, natural terrain, landslides and other slope deformations, as well as physical factors that affect stability, functional and operational reliability of objects. Monitoring is focused on the evaluation of those geological factors (geofactors), which unfavourably affect the overall quality of the environment and indirectly endanger health of the population and even their lives. The present article highlights the state of geological factors of the part of monitored area of the Dargovských hrdinov housing estate in relation to the geodetic survey of observed points by the GNSS technology, using the method of static measurement. The results of geodetic monitoring and monitoring of geofactors in individual epochs of data collection are subsequently graphically visualized for better clarity.

Keywords: GNSS, geo-factor, landslide

EFFECTS OF INSOLATION ON A HORIZONTAL TILT OF SAINT GEORGE BASILICA´S TOWERS AT PRAGUE CASTLE

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ABSTRACT

The measurement of historical monuments is one of the basic parts of engineering geodesy. The area of Prague Castle is being measured for many years, but continuous and precise measurement is being done only for a few years. One of the oldest monuments of Prague Castle is a Saint George´s Basilica with its two towers. For a clear evaluation of a horizontal tilt of the towers it is necessary to know outer influences such as temperature, humidity, insolation etc. The towers are really special objects, because a horizontal tilt on the top is mostly influenced by the change of structure in the lower part. The article is focused on influence of insolation on the top of the towers during the day. For measuring of the tilt a total station was used, and a polar method for a calculation. For better understanding of horizontal tilt of the towers several measurements in various parts of the year and with different degree of insolation were compared.

Keywords: tower, tilt, insolation

ELIMINATION OF THE FRAGMENTATION OF LAND OWNERSHIP AS AN INITIATIVE FOR POSITIVE CHANGES IN A COUNTRY, SPECIFIC (IMPLEMENTED) EXAMPLE – VEĽKÉ VOZOKANY (SLOVAKIA) PROJECT AREA

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ABSTRACT

In this paper, we show how to solve problems associated with excessive land fragmentation in Slovakia on the example of the land consolidation project in the area of Veľké Vozokany (total covered area – 988 ha, arable soil – 740 ha, total number of owners – 1201, number of unknown owners – 870, number of ownership relations – 16581, average parcel size – 0.22 ha, average number of parcels per owner – 14). High fragmentation of the land currently limits rural landscape modifications, including measures that could protect the area from natural disasters (e.g. ongoing water erosion, alluviation of water flows and water areas). It is necessary to find alternatives how to solve this situation as soon as possible, in spite of opponents who do not acknowledge positive effects of land consolidations, although these are apparent/documented in other countries. We illustrate methodological practices used in ownership restoring in Slovakia and mention some of the ways that allow relevant design of functional organization of the country. We also put ownership in relation to the protection and creation of the landscape. Main problems in the area have been analyzed from the water management, ecological, and road-network aspects, respectively. Everything described here is based on the real-life situation in the project area. Main changes introduced by the draft of measures are quantified and graphically illustrated (e.g. expansion of the network of country roads from 9 km to 18 km, new erosion control elements covering 3 ha, ecological elements area increase by 40 ha). We provide examples of changes in the ownership relations, structure of the country as well as the quality of life in the project area.

Keywords: land consolidations, ownership, country, land fragmentation, ecology, Slovakia

FAST ASSESMENT OF BUILDING DAMAGES USING LASER SCANNING METHOD

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ABSTRACT

All constructions are permanent subjected to risk factors and monitoring damaged buildings so, in this case requires the use of techniques which provide rapid and safe measurements even in emergency conditions.
Improvement of geodetic instruments, technologies for measurements and automated data processing has created new possibilities for their use in civil engineering.
Terrestrial laser scanning (TLS) method is accurate, fast and can satisfy these requirements, since they produce dense point clouds in little time and also allow an accurate geometric modelling of observed buildings.
The data can be combined with photographic images obtained by a high resolution camera, using computer software, in order to produce building models.
This paper presents the application of terrestrial laser scanning for the assessment of building damages located in Bucharest. The results can be used to take decisions quickly and effectively regarding damaged buildings even in emergency conditions.

Keywords: terrestrial laser scanning, building damages, point clouds, emergency, Leica Scan Station

FUZZY FUNCTIONS FOR DIGITAL TERRAIN MODEL

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ABSTRACT

This paper presents the use and definition of fuzzy functions for solving surveying, mapping or other specific problems for geographic information systems that benefit of interpolation methods. Digital terrain modeling is widely used to understand reality, but also for understanding natural phenomena and processes. Using data collected in the field and modern techniques of modeling as fuzzy functions, predictions can be done concerning the evolution in time of natural processes. One component of the digital terrain model (DTM) realization it is the terrain modeling process.

Keywords: DTM, statistical analysis, TIN, fuzzy functions, MatLab

GEODETIC SURVEY AND RESTORATION OF IMPORTANT ARCHAEOLOGICAL SITE IN THE SLOVAK REPUBLIC A CELLAR IN THE CADASTRE UNIT FRIČKOVCE

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ABSTRACT

The village of Fričkovce was founded based on the German (emfyteutic) law in the 14th century at the Kobyly estate, belonging to the nobles of Perín. For the first time, it is mentioned in the portal tax register from 1427 under the name Frychhaw. 24 peasant settlements were situated here. In the 15th – 17th century, the village was owned by several noble families, namely Mariáši, Bornemis, Putnoki, Semer and Bočkaj. In the 18th century, the family of Klobušický acquired Fričkovce. Construction of the wine cellar, which is the subject of archaeological examination and geodetic survey, is associated with this family. Significant immovable findings, which were properly geodetic surveyed and recorded by archaeological documentation (general planimetric situation of discovered artefacts), were discovered by archaeological examination in the area of exploration.

Keywords: archaeological examination, historic cellar, geodetic survey

GEODETIC WORKS IN THE CONSTRUCTION AND RECONSTRUCTION OF WINTER SPORTS FACILITIES

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ABSTRACT

The Slovak Republic offers many interesting places for sport and tourism activities. Members of the Department of Geodesy, Faculty of Civil Engineering of University of Žilina, has been long term concerned with issues related to geodetic surveys, project activities, and setting out of sporting transport facilities in the known resorts, such as Mala Fatra, Vysoké Tatry, and Nízke Tatry. In this contribution will be described the following construction activities in detail:

- reconstruction of the ski jumps HS 100 and in the Vysoké Tatry,
- surveying works for the project of chairlift in resort Vrátna (mountain chain Malá Fatra),

The main task is to describe the used instruments, surveying technologies and analysing accuracy for individual buildings.

Keywords: Geodesy, engineering, projecting sports facilities

GEOMECHANICAL MONITORING OF THE MASSIF OF ROCKS AT THE COMBINED WAY OF DEVELOPMENT OF FIELDS

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ABSTRACT

In the paper are presented the results from the observed geomechanical processes arising from the combined method (originally by a quarry, then through underground mine) for mining mineral deposits of goldmine "Akbakai zone". It is proposed a method for assessment of the rock mass, which allows taking into account the features of the geological structure, undermined strata, and improves the quality of geomechanical mining. In turn, the results of geomechanical predictions enable us to determine the most dangerous areas where regular geophysical and geodetic surveying observations have to be performed for localization of the zones of disturbances.The structure massif of rocks was studied using both traditional methods and advanced techniques based on 3D- scanning technology and GPR survey.

The article summarizes the experience of the successful use of techniques, both traditional and seismological methods in the monitoring of geomechanical condition of rocks.

The results of geomechanical monitoring of massif for eight years (2002 - 2010 years), showed that the coordinate deviations of the frame working stations from their initial position are within the accuracy of measurements.

Keywords: laser scanning, mining surveying, innovative methods

GNSS BASED STRUCTURAL HEALTH MONITORING SYSTEM FOR HIGH-RISE CONCRETE CHIMNEYS

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ABSTRACT

This paper describes results of projects which have been led by the Centre of Applied Geomatics at Military University of Technology since 2008. During this period different solutions were developed to use Global Navigation Satellite Systems as reliable source of construction geometry monitoring. This is crucial to provide studies of buildings and structures safety parameters. CAG MUT developed laboratory and field tests at different objects to create efficient, high accuracy measurement solution for constructions geometry real-time monitoring. Results of the first applications of GNSS based systems on real structures (bridges and high-rise industrial chimneys) in Poland are described in this paper. Results of taken test aim to build efficient and reliable Structural Health Monitoring system for high-rise concrete chimneys. Moreover, measurement and telematics concepts are presented in details.

Keywords: GNSS, GPS, SHM, high-rise structures

GNSS RECEIVER'S CALIBRATION METHOD FOR RTK MEASUREMENTS BASED ON ASG-EUPOS NETWORK

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ABSTRACT

In the modern geodesy Global Navigation Satellite System, *GNSS* is one of the most time effective and accurate on-site measurement techniques available. Differential corrections and services for Real-Time Kinematic method (*RTK*) supported by an augmentation system enables access to surveying of sub-decimeter accuracy. However the compatibility of a particular receiver with chosen corrections in RTK measurements is questioned by many users. In this paper we describe a method of receiver calibration for RTK measurements based on ISO 17123-8:2007 standard on an example of GNSS receivers using Polish Active Geodetic Network ASG-EUPOS. Moreover we compare and discuss results of undertaken calibration using four types of corrections offered by ASG services.

Keywords: Geodesy, GNSS, RTK, RTN, Receiver calibration

HIGH ACCURACY LEVELLING NETWORK DESIGN ISSUE ON THE TERRITORY OF THE REPUBLIC OF CROATIA

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ABSTRACT

Since an renewal of the Croatian height reference system is necessary the Republic of Croatia should engage in the design and survey of a new fundamental levelling network. However, a factor significantly limiting the levelling network design seems to be the negative correlation between the specific shape and the size of the Croatian territory compared to the standards of realization of levelling networks having a compact and firm geometrical configuration. In order to examine the potential ways of resolving this issue, a simulation of the height reference system realisation was performed, by means of the revised fundamental levelling network which had originally been used to create the current official height reference system of the Republic of Croatia.

Keywords: height system, levelling network, adjustment, height accuracy, Croatia.

HOLY TRINITY CATHEDRAL AND ITS GEODETIC MONITORING

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ABSTRACT

The building of a shopping centre in the vicinity of the church began in November 2008 by digging the foundation base hole. In the end of January the old splits and tears appeared as well as new splits and tears on the floor and the walls of the church. The splits and tears were probably created by the influence of the construction of a shopping centre which caused an unfavourable change on the subbase of the church. Therefore it was decided to make the geodetical measurements of the height changes of the church to find out the real size of the sinking. The bearing of the basic phase began 2 months after digging out the foundation base. By this time there were already visible tears and splits on the church building. In current times many spacious, deeply rooted and expensive buildings are being built by which the statics of the nearby buildings is being forgotten.

Keywords: geodetic monitoring, terrestrial surveys

ITERATIVE GNSS ALGORITHM FOR POSITIONING USING REFERENCE POINT INDICATORS.

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ABSTRACT

Iterative positioning algorithm for determining the coordinates and systematic error of observations is derived. Numerical example and proof confirm the correct performance of presented algorithm. The main achievement is that using these method the unknowns in the system of equations can be computed without application of linearisation technique nor the least squares method. This iterative algorithm should be further tested for real measurements in many domains of positioning and navigation.

Keywords: iterative positioning algorithm, stadiometric system, navigation, GNSS, reference point indicator.

KINEMATIC MODEL OF RECENT CRUSTAL MOVEMENTS FOR THE TERRITORY OF THE REPUBLIC OF CROATIA

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ABSTRACT

A kinematic model of recent crustal movements has been created for the territory of the Republic of Croatia and the neighbouring Slovenia and Bosnia and Herzegovina. The model is based on the laws of uniformly accelerated-decelerated motion, with motion parameters presented in the form of grid models. This kinematic model stems from models of relative height displacements of the Earth's crust determined on grounds of three different epochs of height positioning of the same benchmarks. The benchmarks are contained in three levelling networks of geometric levelling of the highest order of accuracy, surveyed from 1874 to 1973. Thanks to this kinematic model, it is possible to determine the relative height movements and the velocity of crustal movements for any discrete point or a group of points having a known ellipsoidal position on the territory of the Republic of Croatia.

Keywords: grid, kinematics, movement, height displacement, Croatia.

LEGAL AND TECHNICAL EFFECTS OF PROPERTY LAW APPLICATION IN ROMANIA

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ABSTRACT

The works on establishing ownership of land abusively taken during the communist period were made by committees of Land, for each administrative territory basis. Allotment land to entitled persons was done by specialists, based on the application field of lots of projects in accordance with the legislation in force. In some cases it has been found that some local committees have not elaborated parcelling sketches or plans. In this case, plots numbering and registration neighbors in the datasheets, and subsequently the property titles were made in a defective manner. In other cases, have encountered situations where were drawn parcelling partial plans and based on them, have performed the work of first entry of the real estates. The negative consequences of acceptance the partial parcelling plans, consisted in the appearance of the parcels overlap in graphical database of Cadastre and Land Registration Office, at the moment when the parcelling plan was completed over the all surface of the field. In this context, the cadastral plan approved by the local committee of land and received by the National Agency for Cadastre and Land Registration as definitive plan, generated virtual overlays of parcels, overlays that required correction of coordinates points located on the limits of each parcels. These overlays required the drafting of new cadastral documentation, respectively the repositioning cadastral documentation that needed the owners opinion to be performed, issues which caused dissatisfaction of many owners, and in some cases, generated legal action regarding the respect of property right as technical and legal approach.

Analyzing the legal and technical application of property laws, by the present paper, we intended to analyze the cadastral works made under property laws, but especially, we want to present the correct sequences of cadastral works thereby that the technical and legal effects resulting from correct application of property laws to be positive in all cases.

Keywords: ownership, law, reinstating the possession, owner, database, parcelling plan

METHODOLOGY OF VALIDATION OF AGRICULTURAL REAL PROPERTIES IN POLAND WITH THE USE OF GEOGRAPHIC INFORMATION SYSTEM TOOLS

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ABSTRACT

Due to the specific nature resulting from their destination for agricultural production, agricultural real properties are characterised by specific and unique features. Considering such criteria, as: the soil quality, soil-and-agricultural usefulness, water relations and erosion hazard, a methodology of classification of similar real properties has been elaborated in order to support the work or real property experts in validation of agricultural lands. The developed methodology is based on separate evaluation of particular criteria by assigning them the values of weights (reclassification) and then by listing them in order to obtain the resulting map, which presents classification of real properties, which are similar to the real property under validation. The resulting map image was also considered as the useful tool in effective administration of real properties at the local government level; its importance as a widely accessible information tool for the local society was also stressed. Investigations covered the area of a typically agricultural village, which is characterised by the diversified terrain relief. In order to achieve the assumed objectives, analytical functionality of Geographic Information Systems (GIS) were utilised, together with the land register database, the vector soil-and-agricultural map and the register of real properties prices and values.

Keywords: agricultural real property, real estate market features, spatial analyses, GIS

OBSERVING CHANGES IN ELEVATION CONTROL POINTS

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ABSTRACT

Mathematical statistics is now a standard tool without which modern science, technology and economics cannot do. Article serves to become familiar with the theoretical foundation deformation investigation, theory of errors and smoothing. Levelling network can be processed by the method of least squares (LSM) based on regular Gauss - Mark Models. The process consists of geodetic networks processing the measured values in general construction of a theoretical model of deterministic and stochastic, and then a statistical model. The only way to get information about the concept is a direct measurement using an implementation of the vector. The processing of measured elevations in the network was based on the general relationship that are a function of elevation offset the high points and measurements are burdened with actual errors ε . However, in terms of an effective approach in defining the date geodetic network is preferable to use model settlement intermediary measurements with the conditions, which allows a more flexible approach in defining the date geodetic network and also allows examining the stability of reference points within a single process. Date elevation is assigned based on the network purposefully elected, each independent of conditional equations lying G^T on the estimated parameters.

Track extremely slow forms, eg. Lateral movement (mm/year) or tectonic movements of the fault structure was replicated monitoring optical-mechanical device dilatometer TM-71, which is capable of detecting motion and micro-displacement in three directions and also is able to record in the two rotation axes. Facilities should be complete information on the movement of cracks using Moire, which were successfully implemented precisely measuring instruments for cracks. Moiré effect is mechanical interference that appears in the form of black and white stripes, light induced the upstream grid. Moire density increases with the density of the grid and grid movements evoke movement strips.

Keywords: the vector of corrections, the configuration matrix, the cofactor matrix, the levelling

OUTLIER DETECTION IN SURVEYING NETWORKS*

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ABSTRACT

The paper refers to the robust estimation methods, which allows to eliminate outliers in surveying networks. Network adjustment is performed by the method of least squares. A key problem is the correct selection of weights, resulting from the different standard deviations of observations. In the case of gross errors their impact on the results of the alignment can be minimized by reducing the weight of outstanding observations. The second solution is the elimination of such observations as they were detected and re-alignment this network. In addition to the presentation of the well-known features, damping solution, iterative solution was presented based author idea. The calculation is illustrated on the one-dimensional random variable. Also presented the final results of the flat network adjustment by the proposed algorithm to eliminate outliers.

Keywords: outliner, surveying network, robust estimation

PRAGUE CASTLE STABILITY DETERMINATION BY THE ROBUST TWO DIMENSIONAL TRANSFORMATION AND ITS ANALYSIS

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ABSTRACT

In the area of Prague Castle there is already about 10 years of periodical measurement of the height and positional changes in the buildings and structures being performed. This paper is focused on the positional part, the measurement was carried out with use of precisely measured polygons. Until now, these measurements have been evaluated only locally with respect to each building and its stability without an overall view of the situation of possible movements of individual parts of the surface of Prague Castle. Whereas there are height shift of some points between epochs undoubtedly, a new and complete adjustment of each measured epoch and mutual assessment of changes between epochs using robust analysis of the linear 2D transformation between epochs was conducted. This comparison shows the relative movement of certain parts against another. The results are consistent with current knowledge of the geology in the area of the Prague Castle.

Keywords: robust analysis, deformation analysis, precise levelling, Prague Castle

PRECISE POINT POSITIONING USING REFERENCE POINT INDICATORS

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ABSTRACT

New method is proposed for precise determination of 3D point coordinates and for estimation of systematic bias of carrier phase measurements such as: carrier phase ambiguity and receiver clock correction, and other systematic bias burdening the measured distances to satellites. It can be done by using reference point indicator definitions. The proposed method does not require the implementation of linearization technique for non-linear observation equations nor application of the least squares method. This solution can be extended for any number of observation epochs and for any number of observed satellites by using n −reference point indicator definitions.

Keywords: Precise Point Positioning, GNSS, ambiguity resolution, clock correction, systematic bias

PREPARATION OF ELECTRONIC TOTAL STATIONS (AND ELECTRONIC DIGITAL THEODOLITES) FOR OPTIMAL ASTRONOMICAL OBSERVATIONS

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ABSTRACT

Using electronic total stations (and electronic digital theodolites) in the process of making angular observations bring a whole set of advantages: electronic recordings of angles readings, the possibility of correction in real time of the angular observations from systematic errors components, the possibility of attaching of Charge-Coupled Device (CCD) image sensors for accurate readings of the angular values, the fast identification of the stars in the second position for robotic total stations, using the internal quartz clock for time registrations (timestamps), etc. The practical implementation of each of the above listed possibilities lead to inherent challenges: the physical attachment of CCD image sensors in the total station optical system, obtaining with accuracy of calibration values that enter in the calibration functions, bringing total stations automatically in the second position together with the specific diagonal eyepiece, time corrections for the internal clock, etc. In this article, the authors focus on obtaining accurate calibration values for calibration functions and investigate the possibilities of using total stations only in the first position of the telescope to conduct angular observations, with all the inherent advantages that result from this process.

Keywords: electronic total stations, angular calibration, CCD, image sensor, astronomical observations, angular observations

PPROJ.4 CARTOGRAPHIC PROJECTION LIBRARY AS 3D TRANSFORMATION TOOL IN CZECH CONTEXT

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ABSTRACT

Coordinate transformation is the fundamental problem in geodesy. The PROJ.4 cartographic projection library together with EPSG geodetic parameters dataset is well known for its ability to transform coordinates across national coordinates systems mainly for GIS purposes. This paper focuses on PROJ.4 ability to transform coordinates with higher precision required by practical land surveyors. The whole task is solved in context of Czech Republic. This means we face up to the problem of Uniform Trigonometric Cadastral Network (S-JTSK) distortion, new system S-JTSK05 and vertical system of Baltic Sea Datum (Bpv). The issue was treated by implementation transformation based on original Krovak projection together with horizontal and vertical correction grids.

The precision of transformation defined by this PROJ.4 string

```
cs2cs +proj=lonlat +ellps=GRS80 +towgs84=0,0,0 +to +proj=krovak +ellps=bessel +nadgrids=etrs-jtsk_v1202 +geoidgrids=etrs-bpv_v1005
```

with two correction grids one for horizontal and one for height correction can be expressed by these mean values and standard definitions. The mean values for dx, dy and dz are -0.004, 0.007 and 0.003 m and corresponding standard deviations are 0.003, 0.006 and 0.008 m. This precision is close to requirements of Czech Office for Surveying, Mapping and Cadastre but does not fully satisfy its criteria. The new unofficial S-JTSK05 system with Modified Krovak projection had to be implemented to compute horizontal correction grid of S-JTSK.

Keywords: proj.4, coordinate transformation, JTSK, Bpv, Krovak

PROTECTIONS AND MONITORING OF EUROPEAN TRANSPORTATION ROUTES IN UPPER SILESIA MINING AREA

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ABSTRACT

The paper refers to the issues related to linear transport structures like roads and railway lines located on areas with the ground deformations caused by mining. Polish Upper Silesian agglomeration is a cluster of neighbouring cities forming a strip about 70 km wide with highly concentrated industrial and business activities. It is also a large transportation center - due to both the geographical location as well as the volume of transport. The construction and management of highway and railway lines in Upper Silesian urban agglomeration is a specific task. This is mainly because of the need to take into account strong ground deformations caused by intensive underground mining activities. Not only in still active coal mines, but also because of previous often forgotten mines, used over hundred years ago for extraction of silver, zinc, lead or salt. The paper shows the example of electronic monitoring system which was applied during construction of motorway A4 and A1 in Upper Silesia.

Keywords: mining surface protection, transport, monitoring, ground deformations, roads, railway

QUASIGEOID FITTING TO THE GNSS/LEVELLING BENCHMARKS IN IASI CITY AREA

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ABSTRACT

Adoption in Romania of the ETRS89 European datum implies the need for a coordinate transformation model relative to local datum, which has the characteristics of uniqueness, simplicity and accuracy. When the application relates to the 3D integration of the spatial data, the main problem consists in the introduction of precise gravity related heights in the local system. This can be resolved by correcting the quasigeoid surface resulting from a regional gravimetric model, in relation to data from GNSS and levelling measurements. The case study uses the corrections provided by the EGG97 European quasigeoid model with applications in Iasi city area, Romania. A comparative study will be performed using only interpolation or combined analytical and interpolation methods in order to obtain a precise local quasigeoid model.

Keywords: quasigeoid, interpolation, height, accuracy, transformation.

REAL ESTATE DUE DILIGENCE ON THE EXAMPLE OF THE POLISH MARKET*

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ABSTRACT

A thorough evaluation and analysis of the real estate market when buying or selling real estate is not a strong point of Polish real estate market. The parties buying and selling and often believe that they themselves are sufficiently qualified to conduct real estate transactions. Meanwhile, in-depth analysis of the legal process, economic, planning and construction is rare and requires a combination of several professions. Hence, the introduction of a due diligence in advising real estate is a valuable change that could revolutionize the current view on real estate transactions. A comprehensive study of the property allows you to provide detailed information to enable avoidance of risk, which may adversely affect the price of the property and the entire transaction. It is important to analyze in detail the land registers, possible changes in the area around the property as well as financial outlay which will require the purchase of property and the prospects of obtaining funds for the purchase and maintenance of the property. Changes made axle 1 January 2014 concerning the deregulation of the profession of real estate agent on the one hand opened the market for new professions, the other removed the responsibility of the people uneducated in this area. The article presents the general principles of the institution due diligence and give an example of an analysis based on the selected plot of land and premises.

Keywords: due diligence, market analysis, legal status of the real estate, audit

REFERENCE FRAME REALIZATION IMPACT ON NETWORK DEFORMATION - GEODYNAMIC RESEARCH IN TECTONIC STABLE AREAS

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ABSTRACT

Observations from navigation satellite systems (mainly GPS) from many years are used for the Earth's crust movement and deformation monitoring. Today we have a possibility to detect the smallest displacement (at mm level) and thanks to greater density of the networks in recent years accurate deformation rate field can be provided. In Central Europe, where the relative movements of the Earth's surface are small, one should be careful to interpret the results of GPS measurements, specially in case if data from the GPS stations not designed to measure Earth's surface movements are used. Therefore, there is a need to develop method that allows to verify the reliability of the strain rate maps calculated from GPS networks. This will allow to verify if observation from GPS stations situated in tectonically stable regions give consistent results in comparison to geological surveys or if they present seeming deformation directions and Earth surface movements. The project result will also try to answer the question what is the demand for new GPS stations set up strictly for geodynamical purposes. This is especially important in the context of preparations for the EPOS (European Plate Observation System) project, which main objective is to integrate the existing infrastructure (including GPS stations) for the purpose of various Earth sciences. The paper shows how the reference frame realization of Polish network (ASG-EUPOS) affects the direction of the principal axes of the strain rate tensor and its values.

Keywords: GPS velocities, GPS strain rates, reference frame

RESEARCH ON THE FORECASTING OF THE SUBSIDENCE PHENOMENON AT EM LIVEZENI, ROMANIA - USING THE INFLUENCE FUNCTION METHOD

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ABSTRACT

The paper fits in actuality treating aspects of which the apparition and evolution of the surface's movement and deformation under due to the underground exploitation is connected.

The ruin of the rocks that cover underground excavations gives birth to the subsidence phenomenon, which has a bad influence that can extent on all covering rocks' lengths till the surface, and it manifests on a very long period of time, even after the productive activity stops.

The whole mining activity produces, due to its specific, multiple and various negative effects on the environment, exemplified by: modifications on the relief, manifested in the degradation of the landscape and movements of the houses and industrial objectives in the exploitation areas; the degradation of the field through surface's vertical and horizontal movements, provoking possible accidents and so on.

In this paper I'll present the current situation on the influence of the underground mining exploitation on the surface fields and constructions, in the conditions of the Jiu Valley mining perimeter.

After the data from the measurements has been processed and after the results have been interpreted, by comparing the real submersion, resulted from the measurements, with the values of the influence factors (this has been distinguished through different diagrams, graphics and tables) I proposed and used a prognosis equation of the submersion for a point in the exploitation's influence area. This can be applied for all points of the M.E. Livezeni tracking unit and not only.

The study of the underground exploitation's influence on the surface is necessary in order to evidence the movement phenomena and to take the measures for the protection of the surface objectives and the surface itself.

Keywords: mining, subsidence, surface, environment, prognosis

SOFTWARE SUPPORT FOR HELMERT'S TRANSFORMATION OF COORDINATES

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ABSTRACT

The paper describes the old positional datum, the Croatian State Coordinate System (HDKS) and the accompanying projection reference coordinates system (Gauss-Krüger projection), that are influenced by historical heritage and were established in the state that the Republic of Croatia was an integral part of. After the Republic of Croatia had become independent, the need occurred to introduce new geodetic datums in accordance with the national interests and the development of science and technology. New geodetic datums (Croatian Terrestrial Reference System 1996 – HTRS96) and plane map projection (HTRS96/TM) being in official use today were introduced by the decree of the Croatian Government. Ever since introducing new geodetic datums and new reference coordinate system, it has become especially important to transform the coordinates between the old and the new reference coordinate systems. The paper presents the application that makes the transformation of coordinates between the old and the new coordinate system of the Republic of Croatia possible by applying Helmert's seven-parameter transformation. The programme language Python was used for the development of the application.

Keywords: Helmert's transformation, transformation of coordinates, HDKS, HTRS96/TM.

SOME REMARKS ON GEODETIC SURVEY METHODS APPLICATION IN DISPLACEMENT MEASUREMENTS AND CAPACITY TESTING OF INJECTED AND DRIVEN PILES

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ABSTRACT

In the case of conventional static load testing, the measurement of pile settlement may be affected by ground movement due to displacements of the reference beam or anchor piles. The application of direct high-precision leveling enables to provide an independent reference measurement which is free from systematic errors. This method is less accurate than the use of displacement sensors, but still provides good results. As far as vertical static load test is concerned, it is possible to make a mistake regarding the value of settlement; that however does not change, basically, the nature of the load-settlement relationship. When the test aims at reaching a pile capacity (ultimate capacity), necessary for dynamic tests calibration, the piles keep on submerging in the ground anyway, so the dial indicators, as well as the levelling instrument, show "very much", hence the potential inaccuracies or systematic errors are of no importance. For the purpose of the control of anchor piles extraction, geodetic survey is indispensable, as it enables one to control quickly a large number of piles, at the same time ensuring sufficient accuracy (the criterion is such: was the uplift larger than 5 mm?). Construction of an independent reference system is even more complicated when horizontal testing of a pile in a slope is considered. In a static horizontal load test, the acknowledged criterion is the value of displacement. That means that the pile load capacity is understood as the force at which the pile will get displaced at the distance of 10 mm. In this case, any underestimation of the displacement leads to an overstated value of the pile's load capacity

The research conducted at Wrocław University of Technology enabled to collect and summarize results of displacement measurements in course of foundation works [1] and static load testing of piles [3]. Some selected case studies of the use of geodetic methods in vertical (axial) and horizontal pile load testing were presented in the paper.

Keywords: axial load test, lateral load test, geodetic measurements, displacements

STATISTICAL DATA ANALYSIS USED BY MEASUREMENT TESTING

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ABSTRACT

Measurement of geodetic parameters can be affected by a number of factors. These factors can have random or systematical character which can seriously devalue final results. One of the affecting factors is the inaccuracies of equipment which can directly influence measurement. Another negative impact are methods of measurement, environmental conditions and the state or experience of the surveyor. For a required determination for variable accuracy, it is necessary to make set of several observations from which we can define average value and precision.

The paper describes analytical tools of small data sample used in geodesy with precision requirements. The work also brings to attention descriptive data analysis of data sample, assumptions about the independence, normality and homogeneity of sample. Finally, an evaluation of statistical significant value in dependence on named methods by hypothesis testing of dispersion and mean is presented.

Keywords: geodesy, exploratory data analysis, statistical analysis, hypothesis testing

STRAIN GAUGE ROSETTES CONSTRUCTED ON THE EXTENSIVE GPS NETWORK AND ITS APPLICATION IN GEODYNAMICAL RESEARCH

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ABSTRACT

The main goal of presented research was to determine whether the changes of GPS baselines allow for precise and reliable deformation rates designation. The basic task was to determine the optimal method for the GPS data processing, so as to obtained baselines were minimally affected by systematic errors. The study was carried out based on GPS data from 283 EUREF Permanent Network from period 1996-2010. The GPS processing of the 15-years observations was done using the GAMIT/GLOBK software. The entire network was divided into triangular elements (according to Delaunay method). Baselines from 'free solution' were the basis for further study. This was done to eliminate network distortion related to frame realizations. Time analysis allowed to determine linear strain rate of all baselines, which were used to calculate the strain rates of each triangle (similar to the strain gauge rosettes). The results are very promising, but in tectonic active areas, where the geological structure is varied, coverage of the stations is not sufficient.

Keywords: GPS, time series, strain rates, deformation

STUDY ON THE POSSIBILITIES OF THE GEODETIC SUPPORT NETWORK DEVELOPMENT IN ROMANIA USING SATELLITE OBSERVATIONS

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ABSTRACT

In Romania it is used in the work of geodetic, topographic and cadastral local projection system called "Stereographic 1970". And Romania were determined points belonging to continental geodetic networks of global reference systems (WGS84/ETRS89) being conducted in several stages National Geodetic Space Network - NGSN consists of coordinate points known European Reference System ETRS89 . Although permanent stations network in Romania is fully functional and permanent stations spread across the country has reached a suitable density , new networks of support through their specificity cannot always develop at a convenient distance to a permanent station in therefore solutions must be found to achieve them. In turn, a network of support geodetic GNSS can be compensated where appropriate, in a different way , as free network partially constrained or constricted . In this paper will be considered and addressed different positioning modes and some variants of calculation, clearing and transformation, presented and compared with each other , yielding interesting findings of interest to improve the positioning of GNSS support networks. The main cases analysed in this paper is Supporting the development of a point of National Geodetic Space Network (NGSN).

Keywords: sateleitare observations , NGSN, reference systems , geodetic network

TAXONOMY OF REAL ESTATE PROPERTIES WITH THE USE OF K-MEANS METHOD

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ABSTRACT

The article presents taxonomy of real estate properties, namely premises, with use of k-means method. The developed approach separates groups (clusters) of premises with similar characteristics, which do not depend on spatial location. The research was carried out for Siedlce, the city located in the middle east of Poland. The analysis involved 1873 residential properties which were subjects of transaction in 2007-2011. In grouping procedure, the following characteristics were taken into account: floor, area, date of construction, distance from the town centre and standard of the premises. The necessity of determination a priori the number of clusters forced to use agglomeration method before clustering. The distinguished 7 clusters group premises with similar non spatial characteristics affecting the value of the premises. However, they differ in price which varies between 3295-3979 PLN for 1 m^2. Homogeneity of premises in each group allows elaborate tax map using geostatistical interpolation. The obtained results could influence considerably the effectiveness of properties resources management as well as facilitate decision making.

Keywords: cluster analysis, agglomeration method, k-means method, real estate valuation

TESTING ELECTRONIC DISTANCE METERS ON SHORT ABSOLUTE LABORATORY BASELINE

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ABSTRACT

The paper deals with testing of electronic distance meters (EDM) on absolute laboratory baseline. The EDM baseline is made up of 16 concrete pillars with forced centering and its length is 38.6 m. It is used in accordance with the rules for very precise measurement. To determine the coordinates and distances between pillars, very accurate industrial instrument, Leica Absolute Tracker AT401 was used (accuracy of distance measurement: 10 μm, accuracy of direction measurement: 0.15 mgon). The coordinates were determined by adjustment of polar measurement from 3 pillars. The lengths between pillars were determined with an accuracy of 0.02 mm. The baseline is used for testing EDMs of total stations that are used for accurate measurement for purposes of mechanical engineering. The EDMs were tested to determine the sizes of systematic and random errors on short distances which are common in engineering surveying. Repeated measurements were also used to determine time stability of the errors of the distance meters and the differences among the EDMs built in the same type of instruments. The main aim of the tests is to determine the real standard deviations of the distance measurement, the real systematic errors and their change depending on the distance and to develop procedure to apply the acquired information to make results more accurate and reliable.

Keywords: EDM baseline, standard deviation, pillars, forced centering plates, accurate lengths.

THE ANALYSIS OF GEODETICAL BASES USED IN ACHIEVEMENT OF UNDEGROUND MINING WORKS

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ABSTRACT

Geodetic networks used in mining areas must be very accurate especially in situations where access in the underground is via two different locations positioned away from one another.
Every place for access in the underground should have a basis for measurements, well determined as position and orientation in relation to the basis used at the other location for access in the underground.
This requires that the design of geodetic networks on mining basin surface must find the optimal geometry of the network and the optimal schedule of topographic measurement, so that, the topographical bases that will be used in future for underground works to be well correlated relative to one another.

This paper shows how the shape of network and measurement errors affect the results, namely the quality of the topographic bases. The paper also presents methods that can improve the quality of results.

Keywords: measurements, geodetic networks, errors, accuracy, underground mining works

THE GOODNESS OF FIT OF LINEAR REGRESSION MODEL IN THE DETERMINATION OF PERMANENT STATIONS' VELOCITY

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ABSTRACT

The velocities derived from permanent GNSS stations play more and more significant role nowadays. Therefore their reliable estimation becomes crucial. These velocities and their uncertainties are involved in the kinematic reference frames determination and numerous analyses and interpretations in the geodynamic studies. They are commonly determined with the Least Squares Estimation (LSE) by fitting the trend into changes of topocentric components (North, East and Up). The goodness of fit of such a trend, interpreted as velocity uncertainty, is estimated basing on the differences between the topocentric changes and modelled values. In this research, the changes of daily topocentric components from ASG-EUPOS and selected EPN stations were used. We investigated the goodness of fit of the linear regression line into topocentric components for velocity determination. It was estimated with the coefficient of determination (referred to as R^2) and residual error (*RE*). The R^2 values close to 1 prove the well fitted LS line into the time series, while lower values are the effect of unremoved (or improperly removed) outliers, offsets and seasonal components. This clearly demonstrates how determination of the velocity of permanent stations can suffer from the correct data pre-analysis.

Keywords: GPS, ASG-EUPOS, velocity, goodness of fit

THE INSTITUTION OF PROPERTY IN THE NEW ROMANIAN CIVIL CODE

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ABSTRACT

The property is the absolute, exclusive and perpetual right of its owner, perhaps one of the most important guaranteed rights, of which a person can enjoy, an individual (physical person) or a juridical person. Taking into account the recent change in Romanian civil legislation, we consider the present scientific material very useful, for an overview of this institution under the auspices of the New Civil Code [1].

By article 552 NCC [2]: "Property is public or private". With reference to the Romanian Constitution, art. 136 provides: "(1) Property is public or private. (2) Public property is guaranteed and protected by the law and belongs to the State or Administrative Units. (3) Riches of public interest, the air, the waters with hydropower national interest, beaches, territorial waters, natural resources of the economic zone and of the continental shelf, and other assets established by organic law, shall be exclusively, public property. (4) Public property is inalienable. (5) In accordance with the law, they can be managed by the autonomous administrations or public institutions or may be leased or rented; also, they can be given for free use to public institutions". In article 44 of the Romanian Constitution we find: "(1) The property right and claims against the State are guaranteed ... (2) Private property is guaranteed and protected equally by the law, regardless of the ownership ...".

The national legal provisions set clear therefore, that the property is divided into two institutions, the public property and the private property. Property classification is very important in this form, for us to understand the legal nature and the applicable regime for each type of property.

We believe that any approach of the property right is insufficient, because of the scale and the importance of this juridical institution. Moreover, the property right, either private or public, it has an elite regulation in most European laws, but also in universal laws, the respect for it and the guarantee of this right also can be found in the fundamental human rights, in the international treaties, and in the Constitutions of different nations. We will try therefore, a brief overview of the new Romanian legislation in the mentioned field, which is already harmonized with European legislation, the result being the New Romanian Civil Code. We believe that the interpretation should be considerably more extensive, but pragmatically, we will try to capture the main theoretical and practical features, to denote the importance of this institution.

Keywords: property, rights, public, private, owner, land, cadastre

THE INVENTORY OF ARCHEOLOGICAL SITES USING A LASER SCANNING TECHNOLOGY

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ABSTRACT

A new surveying techniques and methods of processing the obtained data extend the capabilities of applications of the new technology and software. Significant opportunities in this field enables The terrestrial laser scanner measurement, which allows us to acquire data in 3D space, . The data elaboration with programs to surface modelling give a great source to conduct inventory of objects and also to perform specialist analysis.
In this paper authors present the inventory process using terrestrial laser scanner of the archaeological site - the medieval cemetery in Bezlawki village in Poland. To elaborate data from the measurements different programs, which enable computing the spatial data in three-dimensional systems, were used.

Keywords: terrestrial laser scanning, inventory, cemetery

THE LATITUDE DEPENDENCIES IN THE STOCHASTIC PART OF EUREF PERMANENT NETWORK TIME SERIES

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ABSTRACT

The stochastic part (noises) of the GPS-derived time series has a direct impact on the uncertainties of the linear parameters estimated from this data. The noises are commonly analysed with the Maximum Likelihood Estimation (MLE) that is stated as being the most precise method for this purpose. Furthermore it is a very powerful method for different practical research e.g. investigation of permanent GNSS station's stability. In general, the noises are recognized as the power-law processes characterized by the spectral index κ and the amplitude A. There are three integer values of spectral indices, that stand for the special cases of noises: white noise, flicker noise and random-walk. The most of the papers showed, that noises in the GPS time series are the closest to flicker one, which is the effect of mismodelled satellite orbits, Earth Orientation Parameters or large scale atmospheric influences. Besides, the amplitudes of noise reveal the latitude dependence for vast networks. In this research, the daily changes of topocentric coordinates (North, East and Up components) in the ITRF2005 from the set of EPN (EUREF Permanent Network) stations were used. The time series were obtained by the Bernese 5.0 processing ("repro1" project) performed in the Centre of Applied Geomatics that cooperates at the Military University of Technology as one of the 16 EPN Local Analysis Centres (MUT LAC). The time series were pre-analysed with the median absolute deviation (MAD) criterion and sequential t-test algorithm (STARS) to remove outliers and offsets. The stochastic part of GPS time series was analysed with the MLE method with white plus flicker noise model assumed a-priori. As the result, the amplitudes of the aforementioned noises for all of the EPN stations were estimated. The EPN network is located between the meridians of 27° N and 80° N, what gives the 53 degrees of latitude. The paper presents the comparison of noise amplitudes in relation to the geographical location of permanent GPS stations.

Keywords: GPS, EPN, noise analysis, latitudinal dependence

THE NETWORK THEORY IN THE PROCESS OF CREATING AND ANALYZING FROM VERTICAL CRUSTAL MOVEMENTS

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ABSTRACT

A wide range of interpolation methods are used to build spatial models connected with physical phenomena. Usually, primary data is not placed regularly and the choice of joint is related to the interpolation method used. Through the choice of the interpolation method, we can limit for example the influence of phenomena taking place within greater distances, as well as through the choice of the most advantageous adjoining points. With that choice, TIN -a network of triangles is built. If we assume a linear character of a change in a certain phenomenon, it is then indispensable to delineate the joints between which interpolation will be conducted. Not knowing the dependencies between the values obtained in adjoining measure points, we use assumption and mathematical solutions which define these joints. The most widespread method is Delaney's triangulation. There are, however, methods which do not base on triangulation. In these methods, joining is done via determining mutual relations between adjoining values and seeking a course of similar characteristics. It can be said that they form specific skeletal lines in surface models of physical phenomena. The following article describes an attempt to use network analyses for orgnising a geographical space with relation to physical phenomena (vertical crustal movements). As data, we can find unlevelled linear trends on delineated on vectors between the GNSS stations.

Keywords: model, network, nodes, vertical movements

THE OPTICAL PLUMBING METHOD USING TOTAL STATION

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ABSTRACT

The optical plumbing is a basic geodetic method. Special instrument (optical plummet) is used. The optical plummets are equipped with a telescope with peephole looking both up and down or only up. In these days there are many different works for many different instruments, but most surveying companies only want one universal instrument. Some total stations can be set to the vertical direction (zenith) with using a special angled eyepiece. The article is focused on the use of a total station for optical plumbing. Two methods of optical plumbing were used. The first method is based on the deduction of the vertical position from special target. The second is based on polar method, where the center of the target is surveying. The results from the total station are compared with the optical plummet which is equipped with a special measuring table for precise engineering measurement.

Keywords: optical, plumbing, total station

THE POSSIBILITIES OF USING GIS IN ESTABLISHING GEOMETRY FOR THE MINING PERIMETERS IN ROMANIA

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ABSTRACT

One of the essential activities of mine surveying in Romania is to establish the location and boundaries of mining perimeters, which do not have visible physical boundaries. This activity requires an efficient use of cartographic and geodesic knowledge. In many countries, the lack of cover of topographical maps and/or the lack of geodesic networks, has led to inaccurate positioning of mining perimeters and has created frequent conflicts between the owners of mining licenses. Nowadays, available modern technologies, including satellite images, GPS and the GIS tools can help and make up for those shortcomings. When facing the problems of establishing the geometry of mining perimeters, we can use the GIS, which is a tech tool used for drawing maps, because the official document that is being used in every country for the positioning of mining perimeters is the official map set up by the system of cartographic projections used nationwide (or an equivalent entity).

Keywords: mining perimeter, GIS, maps

ON THE POSSIBILITY OF USING GNSS DATA TO MODEL THE VERTICAL CRUSTAL MOVEMENTS

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ABSTRACT

The availability of satellite data from permanent stations results in a wide application in various fields of science. Long time span of observations makes it possible to use them in the development of models of vertical crustal movements. These models could be determine twofold: absolute and relative. In this article the two aforementioned approaches are described as the case study of Poland. We used GPS data collected on the permanent stations of ASG-EUPOS system, which is the Polish multifunctional system. As input data the changes of the ellipsoidal heights from more than 5 years of observations served. These data was obtained from the routine day-to-day data processing of ASG-EUPOS made by the Military University of Technology Local Analysis Centre (MUT LAC) using Bernese 5.0 software. In the following article tested the correlation between two models of vertical crust movements which were determined by methods: absolute and relative. The obtained results gave an overview on the qualitative and quantitative possibility of the use of data from GNSS permanent stations to construct a kinematic model of vertical crustal movements.

Keywords:GPS, vertical crustal movements models, ASG-EUPOS, eustatic change.

THE REALIZATION OF EXTRAJUDICIAL CADASTRAL EXPERTISE IN ROMANIA

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ABSTRACT

Ownership is a real right, typically the fullest, whereby the holder may exercise his prerogative of a good provided by law. In the event that the ownership of a property can not be determined due to adverse legal conjuncture, the property in question is subject to extrajudicial or judicial cadastral expertise, according to court actions initiated. Areas for which beneficiaries require extra technical expertise are varied: topography, land, real estate advertising (land registry), construction of any kind, territorial planning, agriculture, etc..

In the process of implementing property laws regarding the retrocession of immovable property, may be cases in which the owners are dissatisfied with the technical aspect of reinstating the possession. In this case, they can appeal to a person skilled in the topography and cadastre, person who will make an extrajudicial expertise report. In this report, the expert will answer to the questions regarding the location, shape, size, surface, limitation of real estate etc. and suggest conclusions of resolving disputes.

At this juncture, topographical and cadastral technical expertise is a complex work, with various work steps which are executed with adequate topographical equipment and most of the time in difficult conditions. Solving targets in the spirit of the law, requires the full competence of expert through the technical and legal knowledge and right attitude of impartiality towards the parties. These are the only argument that can lead to appropriate solutions, real and true, in terms of the real owners of the properties in litigation.

Keywords: extrajudicial cadastral expertise, reinstating the possession, owner, Property Title, topographic measurements

THE TOPOGRAPHIC MONOTORING OF THE TERRAIN DAMAGED BY THE EXPLOITATION OF SALT IN OCNA MURES, ROMANIA

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ABSTRACT

On December 22, 2010, in Ocna Mures, a salt cavern collapsed and an approximately 7000 square meters crater was created on the terrain surface, after which the area adjacent to the collapse cone was affected.

Following the redevelopement of the area adjacent to the collapse cone, a system of topographic tracking was implemented ,consisting of stability tracking landmarks.

The purpose of this research consistes of monitoring the redeveloped terrain stability, of determining the horizontal and also the vertical distortion and the displacement parameters based on the data collected from the topographic monitoring. The research is also considering the prognosis of this phenomenon, in order to anticipate and to be able to prevent potential future collapses.

Keywords: monitoring, stability, underground cavity, salt, topographic measurements, landmarks, displacement, deformation, diving, accuracy, prognosis

THE USE OF LOCALLY WEIGHTED SCATTERPLOT SMOOTHING IN THE ANALYSES OF GPS TIME SERIES AUTOCORRELATIONS

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ABSTRACT

The GPS time series autocorrelations are the commonly known phenomena nowadays. Such autocorrelations can be identified both in the deterministic and stochastic part of the data. Their existence in the deterministic part of GPS time series has the form of trend (interpreted as station's velocity) and seasonal components (annual and semi-annual). The autocorrelation in the stochastic part of GPS time series was proven in the form of its power-law long-range dependencies with a numerous of methods. In this research, the use of locally weighted scatterplot smoothing (LOESS) was tested in the autocorrelation analyses. The LOESS method is described by the two parameters – the polynomial order and smoothing parameter. To analyse the LOESS function, we used the daily changes of topocentric coordinates in the ITRF2005 obtained within 'repro1' project from Polish EPN (EUREF Permanent Network) stations. The time series were obtained by the Centre of Applied Geomatics that cooperates at the Military University of Technology as one of the 16 independent EPN Local Analysis Centres (MUT LAC). It was investigated within the research, that the trend-related behaviour is modelled the best by both smoothing parameter and polynomial order equal to 1. The polynomial order equal to 2 with smoothing parameter close to 0.1 fits seasonal components quite well. Greater values of smoothing parameter flatten time series too much, while lower ones detect higher frequency changes. For all of the LOESS modelled curves, the autocorrelation function (ACF) was calculated and its values juxtaposed for different types of modelled phenomena.

Keywords: GPS, EPN, LOESS, time series autocorrelation

TOPO-CADASTRAL WORKS TO DETERMINE THE EXPLOITATION PERIMETER OF MINERAL AGGREGATES ON THE NERA RIVER, NAIDAS, ROMANIA

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ABSTRACT

The topographic elevations for this paper were done within the ballast operations area at Naidas. The area is located along the Nera River, in Caras-Severin County. The topographic and land survey measurements were taken with the Leica TC 800 Total Station, and the data were downloaded with the LGO Tools software. After field reconnaissance and the identification of the operations area, a planimetric traverse and detailed elevation was performed. The calculations of the geo-topographic support networks were done with the TOTAL software.

The (temporary) coordinates of the points to be determined are done automatically. The compensation of the support network is done with the least squares method, the indirect measurement method.

The software creates a DFX file that can be used with the AutoCad package at a later time.

TOTAL 2.0 calculates and, where necessary, compensates any combination of direction and distance measurements, from the easiest (cancellation of registration, multiple intersection, multiple resection) to the most complex ones (various traverses, polygonometric networks, triangulation).

Keywords: topographic elevation, ballast operation, total station, temporary coordinates

TOPOGRAPHIC ANALYSIS OF ELEMENTS USED IN SOLVING OF PROBLEMS OF MINING PENETRATIONS

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ABSTRACT

The paper takes into account the sizes taken from topographical network support and how their accuracies affects achievement of mining penetrations. The main problems are punching shear in situations where the mining works have a spatial arrangement.

The analysis relates to the general case of a work punching minimum length between two existing mining space with the peculiarities that may result. This paper presents computational models for the points of intersection of underground works and is considering a review of how the success of meeting of both underground works depends of angles and distances measured underground. Based on the analysis of punching accuracy, it is important to choose the right place of meeting of two works that are digging.

Keywords: measurements, penetrations, errors, accuracy, underground mining works.

TOPOGRAPHIC SURVEYS AND COMPENSATIONS WITH TOPOSYS APPLIED AT THE B.U.A.S.V.M. TIMISOARA, ROMANIA

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ABSTRACT

The Banat's University of Agricultural Sciences and Veterinary Medicine „King Michael I of Romania" from Timisoara is located in the Banat's Plain, in the western part of the country, and is 70 years old.

Topographic survey was carried out in the University's Campus aiming at drawing a situation plan of the faculties of Animal Husbandry and of Veterinary Medicine using routes supported at both ends by known coordinates and a TopoSys soft to compensate the survey.

Topographic survey was carried out with a Leica TC 805 total station and the support points used were GPS-determined with a Leica Geo Office Combined Programme; the resulting files were transformed with DXF Generate, after which the points were reported in AutoCad with a TopoLT Programme.

To carry out the survey, we used eight old known coordinate points that we determined with a Leica GPS equipment, system 1200, and WGS 1984 coordinates were transformed with a TransDat programme into Stereographic 1970 coordinates.

Coordinates were determined in the Stereographic 1970 projection system and point quotas were determined in relation to the Black Sea level.

Reduced observation compensation is done with the Smallest Square Method with correction equations developed through the indirect method. To filer greater errors, we sued the robust (Danish) method and the TAU test to determine the thrust threshold.

Keywords: topographic surveys, total station, TopoSys, GPS equipment, temporary coordinates, compensation

URBAN CONVERSION AND TOPOGRAPHIC EXTENSION OF RESIDENTIAL LAND IN VIEW OF BUILDING NEW HOUSING COMPLEXES

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ABSTRACT

The need to have a house located in a quiet area, as far from pollution (chemical pollution, noise) as possible, has led to the idea of extending built-up areas and creating new residential districts, urban structures that put into action a series factors that define the broad phenomenon of living. One such project has been initiated in Alba Iulia, a visionary project named "Orizont" (Horizon). This urban project began with the purchase of over 40 acres of farmland located outside of the built-up area. This land was subsequently subject to major topographical projects, such as identifying owners, setting up land parcel plans, ownership titles, property transfer documents, unification and parceling of the housing complex. Based on these projects, the urban zoning plan was drawn up, which led to the implementation of this housing complex, and which imposed a series of local regulations on how the respective land should be occupied and used in full compliance with environmental regulations.

Keywords: urban zoning plan, residential land, topography, housing complex, parcel

USING PHYSICAL AND GEODETIC METHODS IN TRACKING THE CONSTRUCTION ACTIVITY BEHAVIOUR

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ABSTRACT

Evolution of surveying equipment, computer engineering, computer programs and methods of collecting data and transmitting them now allow the combination of physical and geodetic methods in construction activity tracking behavior. To obtain more precise results regarding the movements of a large buildings can be used both geodetic equipment and measuring and control devices installed in body building. This can be integrated into a hybrid system several sensors with complementary characteristics, in order to exploit the strengths of each sensor and to obtain a full spectrum of observations, when some sensors shows its limits. This allow us to integrate the data sets provided in order to obtain a superior interpretation of a building's behavior in time.

Keywords: surveying equipment, collecting data, physical and geodetic methods

USING EXPERTS SYSTEM TO MONITOR LARGES HYDROTECHNICAL CONSTRUCTIONS

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ABSTRACT

Expert systems are part of Artificial Intelligence and given the very promising prospects for their application have attracted the interest of specialists. Hydrotechnical construction monitoring is based on the comparison of predicted behavior with actual behavior. By centralization and data base composition with long-time behavior of of the constructions we can bring important improvments even from the project stage of a structure. Expert Systems work faster than human experts, making faster decisions. Expert Systems contain consistent information (structured in the same way) about an environment subject to hazard; they make the distribution of information to more people at different places possible.

Keywords: dams, monitoring, expert system

USING GNSS BASED SYSTEM FOR INVESTIGATION OF BRIDGES CONSTRUCTION DISPLACEMENTS

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ABSTRACT

Nowadays there is an undeniable necessary for a continuous supply of information about the geometric and dynamic state of the structure. This is particularly important in the case of bridge which are exposed to additional factors such as improper use, overloading, river current with flowing material or extreme weather conditions. System which was developed in Military University of Technology allows to automate the monitoring process with the possibility of continues control of the bridge construction. The main element of the system are GNSS receivers which were used not only for determining high frequency position but also to integrate other sensors included in the system, e.g. inductive displacement sensors, inclinometer or robotic total station. All elements were integrated using control module with data acquisition server.

This article presents the idea of the system, as well as tests which were carried out on permanent and temporary bridge crossings. At permanent crossings GNSS receivers where used to obtain displacements values in both of the horizontal and vertical directions. For improve the reliability of the obtained results inductive sensors and leveling were included into developed system and was tested on a single span temporary crossing located at the Military University of Technology.

The measurement results showed that developed system can effectively monitor the real-time bridges with accuracies providing the opportunity to identify possible threats. Also the system has been designed as an open, which allows its extension to other sensors to increase its efficiency.

Keywords: GNSS, GPS, SHM, bridge monitoring

USE OF AIRBORNE LASER SCANNING FOR HISTORICAL MINING DOCUMENTATION

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ABSTRACT

Airborne laser scanning (ALS) is a new progressive method for topographic mapping that began in the 1990's. ALS has experienced a boom in the last ten years. In the Czech Republic, the general mapping of the whole territory using the ALS method was finished on July 2013. It began in 2009 for the main reason of creating a better digital terrain model (DTM) for better orthophoto production. The ALS data seems to be an appropriate tool for the documentation or detection of historical mining activity often together with archaeological sites on a larger scale; unfortunately the ALS data is generally too expensive to be commonly used for these purposes only. In our research we try to use ALS data acquired by a public service (Czech Office for Surveying, Mapping and Cadastre) for mapping purposes. This data has, in general, lower density than expensive custom-made data, but they can be borrowed for research purposes. The DTM distributed as a TIFF file in a shaded relief form has been used as well as visual image interpretation and topographical maps. Using a shaded surface with a resolution of 1m, we are able to descry objects with sizes from about 10m. Our research is focused on forested areas on the borders of the Czech Republic. In our case project, the historical mining area near Jachymov city on the western border of the Czech Republic was investigated. In the city neighborhood in forested mountain terrain, there are still visible traces of historical mining activity. Our results are the thematical mapping of historical mining activity together with terrain research and by searching in the archives.

Keywords: mining, Jáchymov, ALS, historical object documentation, silver

USING OF DIFFERENTIAL GLOBAL POSITIONING SYSTEM (DGPS) IN INSTRUMENT FLYING

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ABSTRACT

This article focuses on the construction of DGPS (Differential Global Positioning System) approach at specific airports in Slovak republic. In the first part, the article describes standard instrument approaches using conventional radionavigation systems. In the next part the authors shows specific construction of DGPS approach and its usability for instrument flying. In conclusion authors shows the benefits to the practice.

Keywords: GIS, navigation, GNSS, GPS, DGPS, GNSS approach

USING RADAR INTERFEROMETER DETECTION PROGRESS SURFACE

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ABSTRACT

The article shows the results of research for detecting of vertical shifts of the earth's surface based on data obtained from radar images of COSMO-SkyMed and TerraSAR-X satellites with the usage of the differential interferometry method. A displacement map of the earth's surface of a test site and mining area of approximately 900 square kilometers is presented. It is shown that the results of calculations using differential interferometry are consistent with the results of ground-based topographic and geodetic measurements and provide accuracy to within one centimeter. Satellite radar interferometry is a method of remote sensing technology, providing high accuracy of the heights and offsets by using the phase components of the signal.

Keywords: satellite radar images, differential interferometry, earth surface displacement