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*ACTUAL PROBLEMS OF GEODESY, CARTOGRAPHY  
AND PHOTOGRAMMETRY*

**ABSTRACTS**



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## RECENT TECTONIC ACTIVITY OF THE EASTERN SUDETY MTS AND FORESUDETIC BLOCK

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### ABSTRACT

Sudety Mts. area is the north-eastern part of the Bohemian Massif and was tectonically active mainly during Neogene. Sudetic Marginal Fault separates the Sudety Mts. from Foresudetic Block. This area is also active today, what was proved by results of the geodynamic researches conducted over the past 20 years. These studies were carried out in a regional network of GEOSUD and in local geodynamic networks using GPS, geodetic measurements and observation of the crack gauges TM-71. Repeated measurements in the national precise leveling networks of class I and II in the Czech Republic and Poland are the correct set of data to analyze changes of benchmark elevations in these nets. These measurements were repeated on average every 20 years. After the second world war the measurements were made in the 50's, 70's and in the beginning of XXI century.

Analysis of benchmark elevation changes in the leveling networks around the Śnieżnik Massif were performed as a part of this massif deformation study (in Polish and Czech side of the border). Compared the results of these measurements in the 30's, 50's and 70's of the XX century are given in the paper Cacoň et al. (1996).

An initial analysis of benchmark movements in the same networks in period 1975-1999/2003 with particular attention to benchmark elevation changes of the tectonic zones will be presented in this work.

## APPLICATION OF A CCD CAMERA FOR MEASUREMENT OF SLIDE ON THE EXAMPLE OF TURNING MACHINES

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### ABSTRACT

The article presents the problem of geodetic investigation of a lathe using equipment with a CCD camera. Measurements of the lathe's geometry (deviation from linearity the move of apron carriage) were performed at 14 positions in 3 cycles. Studies were made by two independent methods: using a precise geometric leveling method and laser method with CCD camera. To carry out the work the following were used: Ni007 leveling, glass leveling staff, laser diode and a CCD camera, which was connected via a USB cable to the computer.

CCD camera images were recorded on computer disk. The location of the laser spots registered on an image were designated using the author's program written in MATLAB. Averaged results are listed in the tables. The graphs illustrate the obtained measurement errors and the values of deviations. Our results were compared with the distribution of acceptable deviations in vertical sections (norm).

5.

# IDENTIFICATION OF WATER BODIES IN TERRASAR-X IMAGES USING NEST SOFTWARE

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## **ABSTRACT:**

Water Framework Directive in force since 2000 imposes on member states the requirement of constant protection and monitoring of groundwater and surface water bodies. One of the tasks set up by the Directive is to define locations and boundaries of surface water bodies. To accomplish this tasks the analysis of various remotely sensed data can be performed. In particular radar data, especially high resolution images of TerraSAR-X, are very useful due to their independence of weather conditions and both day and night imaging possibilities. The author presents possibilities of water bodies extraction from high resolution TerraSAR-X images using the open source Next ESA SAR Toolbox (NEST) software. Radar images used in the study were obtained in StripMap mode and cover a part of Lower Silesia.

The presented solution not only is useful in terms of fulfilling the requirements of the Directive but can also be used in flood hazard monitoring, eg. to identify flooded areas.

# THE INTEGRATION OF DATA WITH GIS SYSTEM FOR INTERPRETATION OF GEODYNAMIC RESEARCH RESULTS

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## ABSTRACT

In the paper main objectives of a prototype system for interpretation of geodynamic research results carried out in the Middle Odra Faults Zone have been presented. The developed and planned modules of information exchange between data acquisition systems and modelling and interpretation systems have been discussed. The scope of the integrated data includes the results of geodetic measurements (GPS, precise leveling), geological and hydrogeological data and the data processed by outside expert systems. These data are collected and presented in the ArcGIS system. External programs that deliver the processed data are: Bernese (development of GPS observations), Stuttgart Neural Network Simulator (interpretation using artificial neural networks) and ABAQUS (physical interpretation). Exchange of data between programs and calculation control are performed by an application created in Visual Studio.

# BUILDINGS OUTLINE RECONSTRUCTION FROM AIRBORNE LASER SCANNING DATA

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## ABSTRACT

Extraction of building boundaries is a crucial step towards 3D buildings reconstruction, which poses a current challenge in photogrammetry. Additionally, footprint reconstruction may be of interest on their own, for the real estate industry, GIS and automated updating of cadastral maps.

In this paper we propose a comprehensive method for an automated extraction and delineation of building outlines. Since interpolation, as for example grid sampling, may disturb the results causing artifacts, in our approach boundary is extracted directly from the raw lidar points assigned to an individual building. The presented workflow comprises three steps. It starts with identification of the points belonging to each singular building. The second step is to trace the points that compose building boundary. In the last step an adjustment process is applied, that aims in boundary lines regularization.

The external points are detected by computing a modified convex hull. The difference between the original version and its modification lies in the restriction of the searching space from a global to a local neighborhood. It enables to extract concave shapes, which commonly exist in building geometry (e.g. L-shape). The identified points make a substantially jagged outline. In order to identify the straight lines within the subset containing outline points, Random Sample Consensus (RANSAC) algorithm is applied. This method enables to estimate the parameters of a model in a data set contaminated by a large amount of outliers. As the final result we obtain a set of straight lines composing a building outline. Usually, the orientation of the lines is varied and the extracted shape can be very irregular. Therefore, as the last part of our approach, boundaries are subjected to the refinement. We apply the Least Squares Adjustment with regularity constraints, parallelism and orthogonality. The final vertices of the building boundary are obtained by the intersection of the adjusted lines.

The paper shows the consecutive steps of building outline reconstruction, implementation details and the final results obtained from testing algorithms against airborne acquired 3D data sets.

# PROGRAMS OF EDUCATION OF GEODESY AND LAND SURVEYING ENGINEERS IN THE ASSESSMENT OF EMPLOYERS, GRADUATES AND STUDENTS OF WROCLAW UNIVERSITY OF ENVIRONMENTAL AND LIFE SCIENCES

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## ABSTRACT

At the paper presents the results of the questionnaire survey directed to employers, graduates and students of geodesy and cartography study of Wrocław University of Environmental and Life Sciences about the assessment of the programmes of studies due to proper preparation for the profession.

The questionnaire form directed at employers contained the following questions:

- How are you judging theoretical preparing graduates for the profession?
- How are you judging practical preparing graduates for the profession?
- What abilities are present graduates lacking?
- What specialist the most is the company seeking?

The questionnaire form directed at graduates contained the following questions:

- Do you think that studies well prepared you for the profession?
- What abilities did you lack the most?
- What professional entitlements did you get or you are planning getting?

The questionnaire form directed at students contained the following questions:

- What geodetic speciality would you like to work in the future in?
- What abilities will you be lacking in the future, in your opinion?

Questionnaire forms are indicating scores, that current standards of the education and the program of studies on geodesy and cartography generally are adapted for requirements and expectations of employers, but: increasing the number of hours of the practical session is intentional, (in the field) or change of the manner of their realization for more effective and changes in educating in administrative and legal issues are being called for. In the opinion of employers and graduates one should put the strong emphasis for practical transferring the knowledge, preparing the graduate for the independent execution of geodetic basic tasks.



## APPLICATION OF THE LASER PLUMMET TO MEASURE THE LINEARITY OF ELONGATED OBJECTS

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### ABSTRACT

In surveying work the designation of straightness of elongated objects is done by method of constant straight, which requires an instrument setup over a given point. For the implementation of this task, you can use a plummet properly rectified.

The minimum length to the target is a characteristic parameter of each instrument. This value limits location of the measurement points. In the conditions prevailing on the engineering objects it is often not possible to offset the instrument from the test object. At that time the first measurement points can be measured only after setting the instrument at the final point of constant straight.

The method presented in this paper to measure the position of points relative to a specific fixed straight uses a light beam emitted by a laser plummet from a Leica TC407 total station. To use laser the beam of the plummet to measure points located at distances from zero to several meters from the position of the instrument by constant straight method additional instrumentation was applied. The additional equipment includes: collimating mirror, CCD adapter and computer.

In this paper the authors present the concept of the method and the results of preliminary work carried out on the laboratory length base. Preliminary research showed that for distances of 1, 2, 4, 8 and 12 m measuring points on the instrument were obtained respectively from 0.02 to 0.08 mm.

# THE INFLUENCE ESTIMATION OF PITS, ASSOCIATED WITH THE ERECTION OF LARGE BUILDING OBJECTS, ON THE VERTICAL DISPLACEMENT VALUES OF THE BENCHMARKS, SITUATED ON THE ADJACENT BUILDINGS

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## ABSTRACT

The periodic vertical displacement measurements of the control benchmarks, situated particularly on large building objects, determine a principle of explanation for damages to those buildings, localized in a direct proximity of new building-sites.

The precise leveling is the main research method, used in such works.

In addition, it is desirable to use code leveling instruments.

The main factors, that cause possible changes in construction of a building are as following: an unprecisely inventoried irregular ground structure and earthwork associated with doing pits of new buildings.

# LOCAL MODIFICATION OF THE SCALE OF URBAN THEMATIC MAPS AS THE METHOD OF ITS READABILITY IMPROVEMENT

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## ABSTRACT

The urban thematic maps are not easy to read in case of high local concentration of point symbols. The solution might be creating cartograms (anamorphic maps) with intentionally changed scale in the places of cartographic symbol concentration. The presentation includes existing solutions of the problem and authors' proposition of cartogram constructing method. This proposition is based on choosing coefficients for the "polyfocal projection". The results of testing this method is shown on the Wrocław map.

# NEAR REAL TIME ATMOSPHERE MODEL BASED ON THE GNSS AND THE METEOROLOGICAL DATA FROM THE ASG-EUPOS REFERENCE STATIONS ON THE TERRITORY OF POLAND

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## ABSTRACT

Since 2008 in the territory of Poland a EUPOS GBAS system called ASG-EUPOS is working. This system gathers permanently the GNSS data from 130 stations and meteorological (temperature, pressure and relative humidity) data from 17 stations, the average distance between GNSS stations is 70 km. The ASG-EUPOS system is one component of NRT atmosphere model. Paper addresses the problems concerning construction of NRT model of the troposphere on the area of Poland. There is short description of the GNSS network configuration given, then the model functional scheme is given, followed by the potential usage, constraints and limitations.

There are two main fields discussed: GNSS data sourcing and processing scheme, meteorological data sourcing, verification and integration.

In the first part the IGS, CODE, EUREF, GLONASS information center data feeding time regime is discussed. Since the model should be processed in near real time the processing in predominate part rely on the forecast products. There is a need to download the predicted ultra rapid orbits, earth rotation parameters, satellite clocks, ionosphere maps, code biases, satellite crux data and others. Afterwards the data processing scheme based on Bernese GPS Software 5.0 and own perl software is presented. Preliminary results shows fine alignment of the obtained ZTD's with reference data from EPN processing center.

The second part presents all available ground meteorological station in the area of Poland and neighbor countries. The meteorological stations act as a support for aviation (METAR messages stations), or as country meteorological data supply (SYNOP messages stations), also there are stations collocated with GNSS antennas of GBAS system. In this part data feeding scheme is discussed, together with timeline, and time resolution. There is also methodology to validate and integrate meteorological data shown. Also the first result of data integration is presented.

The preliminary results shows that processing of GNSS data for NRT atmosphere model construction is feasible and may considerably improve monitoring capacity of meteorological networks and positioning accuracy of real time and post processing modules of GBAS such as ASG-EUPOS.

## FOREST AND FOREST' ELEMENTS IN TOPOGRAPHIC AND SPECIALIST DATABASES – LCML DESCRIPTION

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### ABSTRACT

Poland is among Europe's leaders when it comes to areas of forests. They occupy 29 per cent. of national territory, are rising in the area of 9.1 million ha. The vast majority of all forests (nearly 7.6 million ha) is managed by the State Forests National Forest Holding.

Data on forest areas determines a very important component for various databases. For the purpose of this paper, topographic and specialist databases were taken for analysis. As a fundamental problem taken under consideration in this paper is widespread diversity of defining and describing forest's elements. Depending on the type and destination of databases, there are many different definitions and classifications of forests and its' environment.

Forest as a component of land cover – in topographic database, forest-based numerical map, and also thematic elaborations prepared for the purpose of forest management are described in heterogeneous way which does not allow for direct data integration. The attempt to describe these elements using a unified standardized language which is LCML is a new solution.

Fundamental idea of LCML is a predefined set of basic elements (BIOTIC and ABIOTIC) enriched in their semantic significance with external characteristics can be arranged in different types of vertical and horizontal strata/patterns to describe a wide variety of distinctive and detailed land cover situations.

The main purpose of the paper is to describe forests and its' elements with the use of Land Cover Meta Language, what could be the huge step into the international data integration.

## 3D MODELING OF THE HISTORICAL MONUMENTS FOR THE OPOLE PROVINCE GIS WEBSITE

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Key words: airborne laser scanning, terrestrial laser scanning, 3D modeling

### ABSTRACT:

Laser scanning technology became widely available in the recent years. Additionally, increasing density of laser scanning data allows accurate 3D model generation from the 3D point clouds. There are numerous applications of such models, e.g. city management, marketing, administration or spatial analyses.

This work presents a project founded by Marshal's Office in Opole, which is held at the Institute of Geodesy and Geoinformatics. The goal of the project is to create 3D models of a few dozen of historic monuments located in the Opole Province. The modelling is carried out on the LoD 3 (Level of Detail), i.e., the results are architectural models with detailed wall and roof structures. The models are generated from the airborne and terrestrial laser scanning data and the digital images. For some objects the data input contains only points acquired by airborne laser scanning and information from the land registration. In both cases, the models are textured with the digital images. The Cyclone 7.1 is utilized to create the models. The image conversion and texturing is performed by own software. The final model is placed on the digital terrain model, constructed from the laser scanning data. Ultimately, the 3D models will be presented in the Internet, using skyline technology.

The paper shows the consecutive steps of the modeling process, encountered problems regarding non-standard objects, suggested solutions and the modeling results.

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