

Natalia Borowiec: **Polyhedral Building Model from Airborne Laser Scanning Data** • Geomatics and Environmental Engineering 2010, Vol. 4, No. 4

This paper presents the semi-automatic method, which only uses ALS data to build a model of a building. This method focuses on modeling the roof, assuming that by knowing the shape of the roof and the digital presentation of the terrain, we could easily obtain the model of the whole building. A unique feature of this method is the sequential regular and irregular tessellations, which are used to obtain analyses of grid and tin. This method consists of three main steps. The first step is to execute the interpolation of lidar points to the grid and then indicate the places where buildings are most likely to be present. The region of interest (in this case, the buildings) is located on the grid using the easy grid analyses. The next step helps us to indicate the edge of a building's roof. Accurately detecting the edges is possible when using the original data but we are limited to the ROI indicated in the first step. The lines which define the roof edges were detected as a result of the TIN analysis. The edges of the building allow us to choose only those points which represent the roof out of the entire „cloud of points“ and proceed to the next step. The third step consists of planes detection, in which we define the shape of the building's roof. The roof planes are detected using the split-merge method in which a LIDAR point cloud is organized and planes are extracted from each voxel. The planes are joined when parameters such as slope, azimuth and height are contained in the definition of boundary. The final step is exporting the building model to dxf format.

**Keywords:** lidar, 3D model, building, reconstruction

Marcin Chodak: **Relationships Between Microbial and Chemical Properties in Mine Soils Reclaimed for Forestry** • Geomatics and Environmental Engineering 2010, Vol. 4, No. 4

Measurement of several microbial properties is necessary for comprehensive assessment of mine soils. Therefore, the applied methods should maximize amount of acquired information. Objectives of the work were to assess relationships between microbial properties of mine soils and to assess of their dependence on some soil chemical and physico-chemical properties. The measured microbial properties included microbial biomass, basal respiration, activities of dehydrogenase, acid phosphatase and urease. Biolog® assay was used to assess physiological properties of soil microbial communities. The

chemical and physico-chemical properties included the contents of C, N and pH in KCl. Spearman correlation was applied to study relationships between the properties measured. Most of microbial properties were correlated with each other. However, the Biolog® derived parameters weakly correlated with Cmic and enzyme activities what indicates that they bear complementary information on soil microbial communities. Activities of acid phosphatase and urease depended mainly on microbial biomass. Positive correlation between Shannon index based on Biolog® data and microbial biomass indicates that in the mine soil the physiological abilities of microbial communities increase as increases the microbial biomass.

**Keywords:** mine soils, microbial biomass, respiration, Biolog®, soil enzymes

Józef Czaja, Janusz Dąbrowski: **Statistical Algorithms for Modelling the Results of Geodetic Observations** • Geomatics and Environmental Engineering 2010, Vol. 4, No. 4

The article presents the principles for linearizing observational equations describing functional relations in the field of geodesy. An algorithm for solving overdetermined systems of equations with a rank deficient coefficient matrix is then formulated. The estimation of parameters which describe the given process is based on the Gauss-Markov model, using the generalized inverse of the normal equations matrix. Variance analysis is used to present formulae for estimating the covariance matrix for the vector of unknowns which is the basis for evaluating the accuracy of the estimated parameters. In the last section, a practical illustration of the proposed algorithm is presented, applied to the modelling of survey observation results in order to estimate the elevation of a water table at four ground points.

**Keywords:** parameter estimation, overdetermined systems of equations, generalised matrix inverse

Paweł Cwiąkała, Mikołaj Skulich, Anna Szafarczyk: **Repetitive Measurements of the Strain State in the Rock Mass Persistently Disturbed by the Mining Exploitation – Focus on the Triangular Rosette** • Geomatics and Environmental Engineering 2010, Vol. 4, No. 4

Underground mining exploitation causes many negative effects on the surface of the mining area. Among the biggest nuisances for the buildings, one should count the arising of squeezing and stretching stress, and the description of the arising deformations is an important element of the safety assessment of the objects on the surface. The measurements and calculations, carried out on measurement rosettes, allow defining strains occurring in the ground in any direction. The article presents the results of the measurements with a triangular mea-

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surement rosette situated over the exploited deposit during the whole process of the wall exploitation. The theoretical description to define the surface tensor of strains was also given.

**Keywords:** measurement rosettes, mining surveying, horizontal distortion, horizontal deformation

Wojciech Drzewiecki: **Sub-Pixel Classification of Middle-Resolution Satellite Images – Evaluation of Regression Trees Applicability to Monitor Impervious Surfaces Coverage • Geomatics and Environmental Engineering 2010, Vol. 4, No. 4**

The aim of the presented research was to test the method of assessing the imperviousness index on the basis of middle-resolution satellite images with the use of regression trees. The task also included evaluation of the applicability of the method to monitor the changes of impervious surfaces coverage. The research has been done in the catchments of Prądnik and Dłubnia rivers (Malopolska region, Poland). The imperviousness index has been assessed for two time periods – current state (2007) and the mid-1990s. The training and verification data for both time periods have been obtained from aerial orthophotomaps for urban, suburban, rural, industrial and commercial areas.

In both time states the best assessment of imperviousness index have been achieved for the variants where the regression trees were built on the basis of all satellite data accessible for the time period. However, it is worth notifying that the variant with the input data limited to three images from spring, summer and autumn provided comparable accuracy of the results. These models have the systematic error between 1.3–2.2%, the mean error between 15.8–16.4% and correlation coefficient between 0.85–0.86 for the mid-1990s. For the year 2009 these values are respectively: 1.4–1.7%, 15.7–16.0% and 0.86. The accuracy of the imperviousness index obtained in the present research is comparable with the accuracy obtained with the use of regression trees in research reported in the literature

The comparison has shown high accuracy of imperviousness index change assessment for the whole population of pixels in verification dataset. The systematic error is 0.1%. However, the obtained assessment accuracy for a single pixel ( $\pm 14.5\%$ ) can be too low for some applications.

**Keywords:** imperviousness index, land cover mapping, regression trees, satellite remote sensing, Landsat TM

Elżbieta Jasińska, Jan Ruchel: **Using a Spreadsheet for Surveying Computations • Geomatics and Environmental Engineering 2010, Vol. 4, No. 4**

The paper features the method of creating a computer application (assuming intermediate programming skills) that shall perform

geodetic computations. Computation of a leveling net is used as an example, as being the most often analyzed by small geodetic companies. In order to perform computations of this kind a proper program is required. The paper shows a way to create a spreadsheet based application providing the particular requirements fulfillment, especially controlling and displaying the computation results.

**Keywords:** surveying / geodetic computations, leveling nets, Visual Basic, small geodetic company, computer programs

Joanna Korzeniowska, Ewa Panek: **Heavy Metal (Cd, Cr, Cu, Ni, Pb, Zn) Concentrations in Spruce *Picea abies* L. along the Roads of Various Traffic Density in the Podhale Region, Southern Poland** • Geomatics and Environmental Engineering 2010, Vol. 4, No. 4

The aim of the paper was to determine influence of traffic density on heavy metal concentrations (Cd, Cr, Cu, Ni, Pb, Zn) in two years needles of spruce *Picea abies* L. along the roads of various traffic density located in the Podhale region, Southern Poland. The samples of *Picea abies* L. were collected along two roads: heavily frequented main road no. 95 Kraków – Zakopane between Chabówka and Nowy Targ and a district road of low traffic density no. 1644 Łopuszna – Dursztyn, between villages Łopuszna and Nowa Biała. The samples were collected along five transects: three at the road no. 95 and two at the road no. 1644 at the following distances from the road: 5 m, 10 m, 50 m and 100 m. Generally, metal concentrations descended according to the increasing distances from the road. The highest concentrations were stated in case of Cu, Ni and Pb at the distance 5 meters from the road Chabówka – Nowy Targ ( $10,1 \pm 1,3 \mu\text{g Cu/g}$ ;  $2,9 \pm 0,2 \mu\text{g Ni/g}$  and  $2,4 \pm 0,6 \mu\text{g Pb/g}$ ), and the lowest concentrations with exception of Cd were stated for both mentioned roads at the distance 100 meters. Traffic density influenced heavy metal concentrations in spruce *Picea abies* L. The differences in metal concentrations along two roads were presented by concentration coefficients, calculated as quotient of metal concentrations at the roads of various traffic density. The highest concentration coefficients at the distance of 5 m were stated for: Ni (2.6); Pb (2.4) and Cu (1.7) and the lowest for Cd (0.5), Cr (0.9) and Zn (0.8).

**Keywords:** heavy metals, spruce *Picea abies* L., biomonitoring, traffic density, Podhale region, Southern Poland

Elżbieta Kowalczyk: **Trophic State Assessment of Dobczyce Reservoir** • Geomatics and Environmental Engineering 2010, Vol. 4, No. 4

In this article, the results of trophic state assessment of Dobczyce Reservoir are presented. The assessment of reservoir's trophic state was performed using traditional trophical indicators and the numeri-

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cal criterion of trophic conditions (ITS). The possibility of the application of the numerical criterion of trophic conditions was confirmed on the base of correlation analysis. The tendency of the eutrophication process development in Dobczyce Reservoir and the dynamics of changes of main eutrophication factors in this reservoir were investigated. The analysis was performed based on reservoir's monitoring data collected in the period of 2002 and 2004. The access to monitoring data was provided by MPWiK S.A. in Krakow (Municipal Enterprise of Water Supply and Sewerage). Methodological basis of the presented research is theoretical and statistical analysis (correlative and regressive), performed using *Statistica ver. 8.0* program.

**Keywords:** trophic state, traditional indices of eutrophication, numerical index

Anna Trembecka, Anita Kwartnik-Pruc: **The Issue of Compensation for Loss of Rights to Property Plots Parcelled out for Public Roads Based on the Example of Cracow** • Geomatics and Environmental Engineering 2010, Vol. 4, No. 4

The article presents some issues which refer to determining compensation for the loss of ownership rights or perpetual usufruct of plots of land parcelled out for public roads, as a result of subdivision surveys, based on the example of the city of Cracow.

The compensations shall be determined under a civil or administrative procedure, according to the rules governing the expropriation of property. The basis for determining the amount of compensation is the market value of the property.

The paper pointed out the practical problems of implementing the compensation requirement arising from the above mentioned grounds by public law entities.

**Keywords:** compensation, division of property, road, property value

Marcin Uradziński, Adam Doskocz: **Initial Analysis of the Accuracy of Position Determination Using ASG-EUPOS NAVGEO (RTK VRS) Service** • Geomatics and Environmental Engineering 2010, Vol. 4, No. 4

ASG-EUPOS system, as a part of Project EUPOS (European Position Determination System), is a new multifunctional system of precise satellite positioning in Poland. It makes GNSS corrections and raw observations collected at 116 reference stations accessible to the users, what provides precise real time positioning, post-processing and supports navigation in the whole area of Poland. This new system, which is based on reference stations network including EUREF-POL, POLREF and EUVN points, accomplishes ETRF89 reference system.

One of the most accurate real time positioning services provided by ASG-EUPOS is NAVGEO service, which is RTK VRS network solution. It enables streaming of RTCM corrections for mobile users by using the latest mobile communication technologies such as GPRS or UMTS in any area covered by a cell-phone network.

Noting great potential of RTK technique (enabling positioning to centimeter accuracy), authors decided to put NAVGEO service into test as a potential tool for map and geographical databases updating. Our approach of testing the performance of this service is based on field experiments and the analysis of both the accuracy and availability of RTK data using mobile wireless transmissions. We investigate the advantages and disadvantages of this service. Experiments were conducted on the test marks which were determined by static occupation (below centimeter level of accuracy) under different conditions (opened areas and covered by trees and buildings). All the tests were performed in the various periods of time using the latest Topcon HyperPro GPS/GLONASS receivers.

**Keywords:** GNSS, ASG-EUPOS, RTK technique surveying