POSITIONING OPPORTUNITIES OF DETAILS FROM THE FOREST FUND WITH GNSS OF HILL-GROWING TECHNOLOGY WITH THE METHOD "FAST STATIC"

Crainic Ghiţă Cristian*, Damian Vasilica Laura**

*University of Oradea, Faculty of Environmental Protection, 26 Gen. Magheru St., 410048 Oradea; Romania, e-mail:gccrainic@yahoo.com
**University of Oradea, Faculty of Environmental Protection, 26 Gen. Magheru St., 410048 Oradea; Romania, e-mail:vasilica8630@yahoo.com

Abstract

Positioning details of forest fund represents an important activity for the forest management having regard to the particular features of the applicative and conditions of working in the forestry sector.

Achieve appropriate end-products of current and future requirements forestry cadastre constitutes a priority objective for the forestry sector, in view of the map currently existing, current and present practical needs.

Technical possibilities and logistics base currently facilitates the promotion of technologies for high-precision positioning of areas occupied by forest vegetation.

GNSS technology allows the application of new methods of work established with some exceptions, respectively the technical conditions of operation.

For work positioning in forest fund there are a number of limitations caused by the existence of forest vegetation in different phases and stages of development and configuration of the land.

Fast static positioning method with its variants (conventional static, fast static) ensure outcomes results that are characterized by a high precision and accuracy.

Key words: spatial positioning, GNSS technology, positioning variants, conventional static method, fast static, processing programs

INTRODUCTION

Although the use of GNSS technology presents a number of significant advantages due to the operating principles and conditions of work that you claim may not be used in conditions where the signal emitted by satellites is altered by different media, especially on land, at the level of surface receivers (Ádám et al., 2004).

A particular situation working with GNSS technology and that pertaining to the land is occupied with vegetation forest, giving that the fact that folianeous system and canopy stands default representing a genuine underlying surface (at least during the season of vegetation) is a disruptive environment for signal emitted by satellites and reached physical level natural land area (Neuner et al., 2002).

As a result, the use of GNSS technology features within these areas occupied by forest massif is limited. Currently there are still constructive models of GPS receivers that allow measurements to be hostile and satellite measurements (in close proximity to buildings, trees, etc.), benefiting from the new position Signal Prediction ™, making it easier for measurements in real time even when RTK differential corrections are received with interruptions (Boş, 2003).

MATERIAL AND METHODS

The case study was made in the management unit (U.P.) I Sîniob, Săcuieni Forest District, Bihor County Forest Administration.

Fig.1 Sketch of case study

For details raisings of the stands analyzed in the study case with technology, we have proposed the use of GNSS system GPS fast static method, respectively, using as bases dense points of trigonometrical control network placed outside the forestry massive or even inside the forest mass, as appropriate. In view of the fact that the length of the vectors of the form is relatively small 2-5 miles and the time of the stationary point of determined is relatively short by about 10-15 minutes (Neuner, 2000).

Since receivers used for the collection of data-Trimble R3 due to specific data from the land register Trimble Digital Feldbook, cannot boot process if there are enough NAVSTAR GPS satellites, it removes the consultation phase of flight and implicitly as a rigorous planning of the periods of record (Boş et al., 2009).

Also, during the preparation for the processing of data collected under the system for calculating Trimble Total Control, you can disable the satellites that transmit data affected by a series of errors by iterative analysis thereof, and in some cases you can remove the processing ranges of records affected by the errors without disable satellites respectively, aspects which bring extra precision spatial position considerably points determined (Boş et al.,2007).

Although the technical rules in use does not refer to the conditions of geometric grids lifting with GNSS technology, namely the minimum number of vectors needed to determine a point, it is necessary to the determination of at least one new triangle, in order to ensure a higher precision (Păunescu et al., 2006).

For survey of details inside the forestry massive and the edge, with GPS fast static method, I designed working sessions of 15 minutes by registrations periods of 15 seconds and reached a series of check points that are (determined with GPS system with a different period of stationary) to analyze the precision and accuracy of positioning made in the particular conditions of work (Hofmann et al., 1997).

The period of work is dependent on the autonomy of operation plus receivers are equipped with the Trimble R3, respectively approximately 6 hours. The recorded data were processed at the end of each working day, from all aspects of the data recorded and to the results obtained (Măsurători Terestre - Fundamente, 2002).

Details and characteristic points respectively, which have been designed to be positioned with GNSS technology in the context of this case study are reported in the orthophotomap of the work zone- fig. 1 (Neuner et al., 2002).

Thanks to software performance data processing, there are certain possibilities for increasing the reliability and accuracy of the final absolute coordinates (Măsurători Terestre - Fundamente, 2001).

Angle of elevation, obstacles and the number of satellites you receive and their geometrical configuration affects considerably the process of positioning (Sabău, 2010).

RESULTS AND DISCUSSION

From the analysis of the chart in fig. 2 is observed that the standard deviations planimetric coordinates of points of detail on the edge and positioned with GNSS technology through fast static method does not exceed 25 cm in length, the maximum frequency of which shall be attained within 5.1-10,0 cm.

Table 1

The coordinates of points by way of static rapid mothod positioned on 06 03 2009

No. point	X (m)	s_x (cm)	Y (m)	s_y (cm)	s_{xy} (cm)	h (m)	H (m)	s_z (cm)	N (m)
170	646282.690	3.6	281348.307	2.2	4.2	177.307	164.621	3.6	12.686
171	646230.380	4.6	281399.179	2.5	5.2	175.854	163.168	4.4	12.686
180	646742.465	5.2	280736.573	3.7	6.3	177.538	164.848	7.1	12.690
1800	646698.292	5.8	280750.772	4.7	7.4	179.616	166.925	8.6	12.690
181	647065.160	4.6	280564.791	3.3	5.7	189.962	177.275	6.8	12.687
413	646325.074	10.8	281267.175	8.7	13.8	177.521	164.835	13.6	12.687
414	646319.636	5.8	281286.500	4.1	7.1	177.049	164.363	5.5	12.686
415	646341.543	9.9	280741.246	8.4	13.0	190.363	177.664	15.0	12.699
418	646349.943	9.0	280455.568	6.7	11.2	200.608	187.903	10.3	12.706
170	646282.690	2.6	281348.307	1.5	3.0	177.307	164.621	2.6	12.686
171	646230.380	3.2	281399.179	1.7	3.7	175.854	163.168	3.1	12.686
180	646742.465	3.6	280736.574	2.6	4.4	177.539	164.850	5.0	12.690
1800	646698.284	4.2	280750.809	3.3	5.3	179.678	166.988	6.1	12.690
181	647065.158	3.2	280564.793	2.3	4.0	189.967	177.280	4.7	12.687
413	646325.067	7.9	281267.128	6.4	10.1	177.535	164.848	9.9	12.687
414	646319.636	4.1	281286.500	2.9	5.0	177.049	164.363	3.9	12.686
418	646349.944	6.3	280455.565	4.7	7.9	200.610	187.904	7.3	12.706

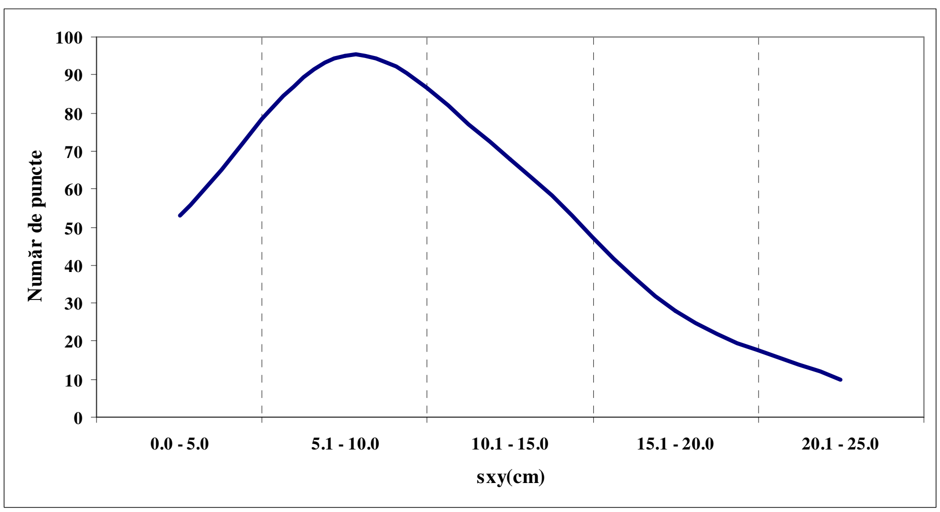

Fig. 2 Standard planimetric deviation distribution on the interval size for the points determined by GNSS technology (static rapid method) located on the edge

Analyzing the diagram in fig. 2 is observed that the standard planimetric deviations corresponding to the points of detail situated on the edge 5,1-10,0 cm represents 37%, from 10.1-15,0 represents 27%, the range

0.0-5.0 is 21%, 15.1-20% range is between 11% and 20.1-25.0 represents 4%.

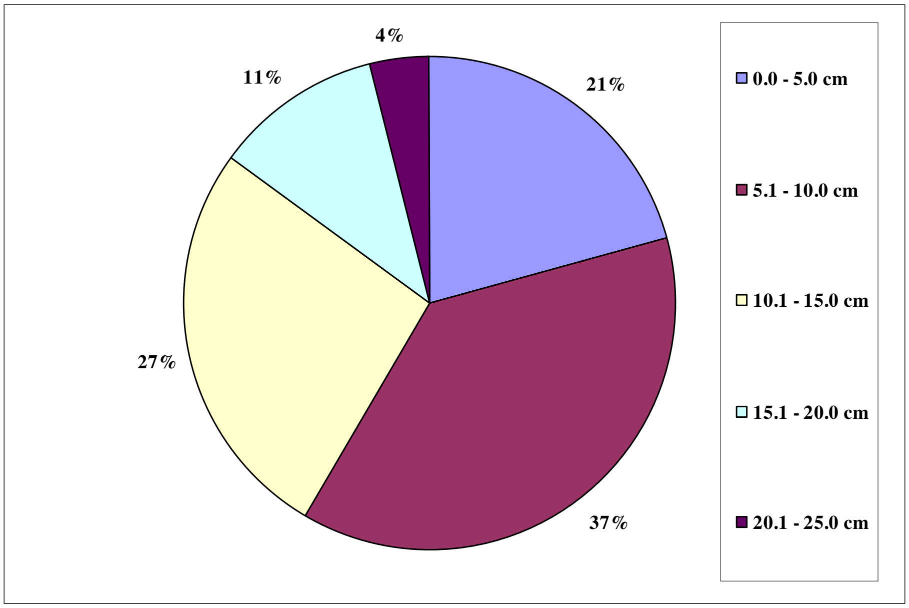

Fig. 3 Percentage distribution of the residuals on planimetric standard deviations size ranges for the points determined by GNSS technology (fast static method) located on the edge

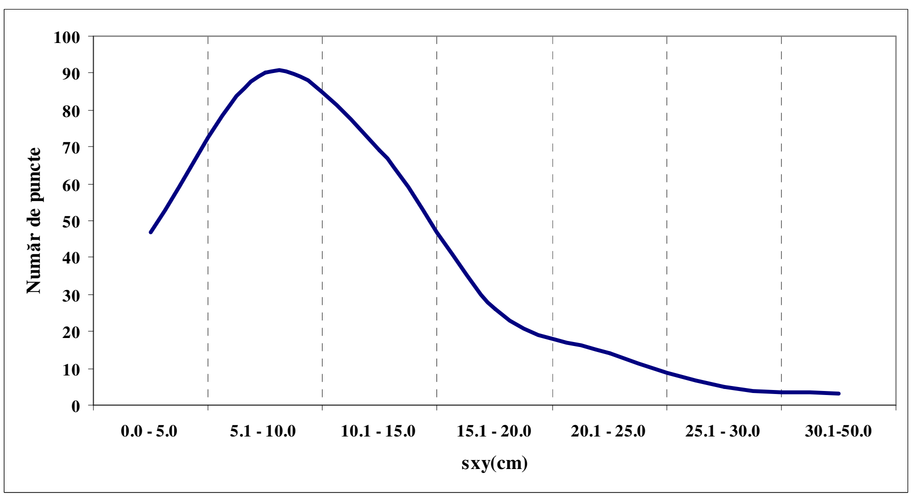

Fig. 4 The corresponding standard deviation distribution of heights size increments for the points determined by GNSS technology (fast static method) located on the edge

From the analysis of the chart in fig. 3 it is observed that the standard deviations for trading points of detail on the edge and positioned by the method fast static exceed the sensitive static value of 30 cm, the maximum frequency of which shall be attained within 5.1-10,0 cm.

Analyzing the diagram in fig. 4 it appears that the range 5.1 – 10,0 cm represents 35%, the range 15,0 cm - 10.1 is 27%, the range 0.0-5.0 cm represents 19%, 15.1-20.0 cm range is 10%, 5,1-10,0 cm range is 6%, 25.1-30.0 cm interval is 2% and 30.1-50,0 range is 1%.

In conclusion, the planimetric coordinates of the points of detail on the edge and positioned through the fast static method 100% standard deviations lower than the present limit of 30 cm.

For the heights, just for a rate of about 1% of the standard deviation exceeds 30 cm.

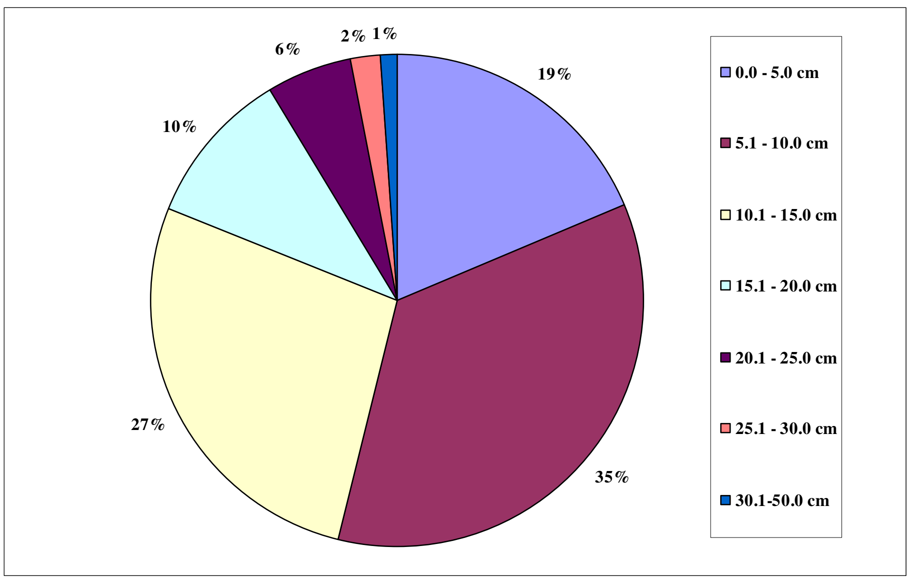

Fig. 5 Percentage distribution of the corresponding standard deviation heights size increments, for points determined by GNSS technology (fast static method) located on the edge

From the analysis of the chart in fig. 5, it is observed that the standard planimetric deviations for the coordinates inside the massif points distributed relatively flattened curve on 10.1-15,0 cm range.

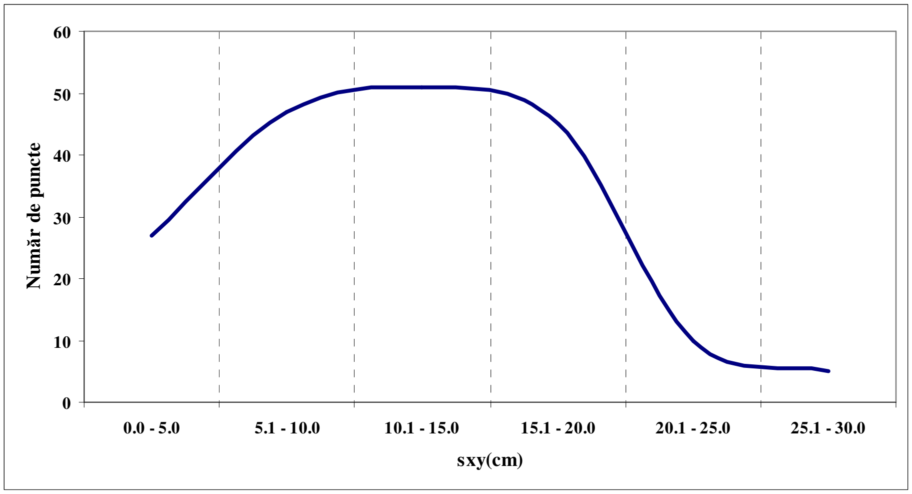

Fig. 6 Planimetric standard deviation distribution on the interval size for the points determined by GNSS technology (fast static method) located within the massif

Analyzing the appropriate information in the diagram in fig. 6 can be seen that the ranges of size standard planimetric deviations 10.1-15,0 cm represents 28%, 5,1-10,0 cm to 25% and 15.1-20.0 cm range represents 24%, differing by 1-4%. The range 0.0-5.0 cm 15%, from 20.1-25.0 cm is 5% and 25.1-30.0 cm interval is 3%.

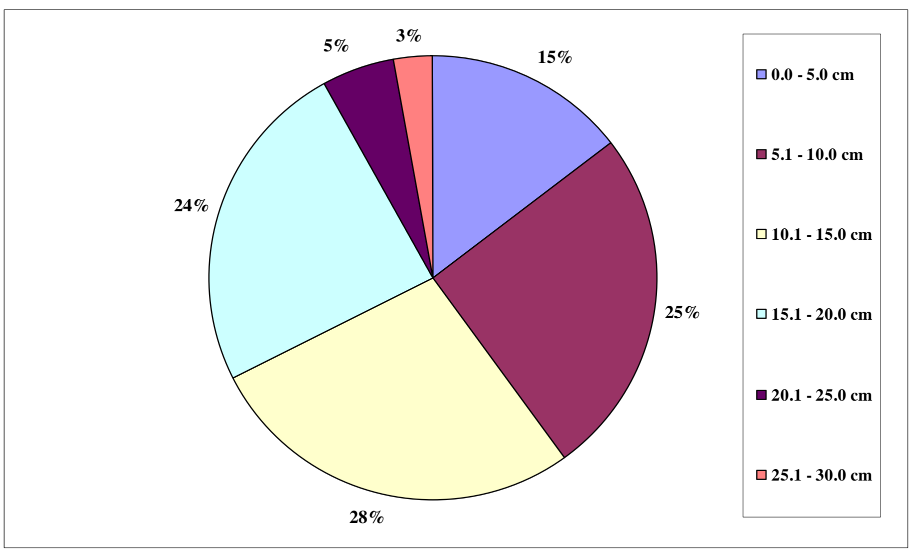

Fig. 7 The percentage distribution of standard planimetric deviations size increments, for points determined by GNSS technology (fast static method) located within the massif

From the analysis of information related to the chart in fig. 7 should be observed that the corresponding standard deviation distribution of heights points of detail inside the massif, takes the form of a normal distributions, the maximum being achieved in the frequencies range between 10.1-15,0 cm, for a relatively small number of points (about 3%) surpassing the value of the standard deviation of 30 cm.

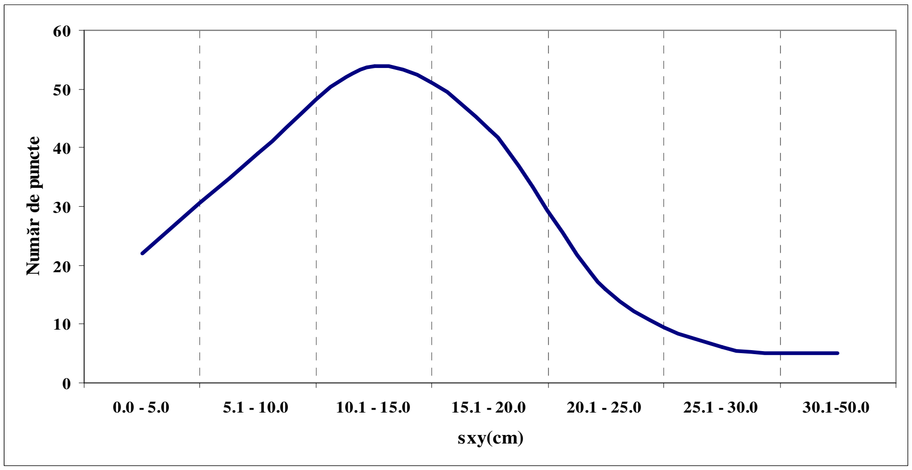

Fig. 8 The corresponding standard deviation distribution of heights size increments for the points determined by GNSS technology (fast static method) located within the massif

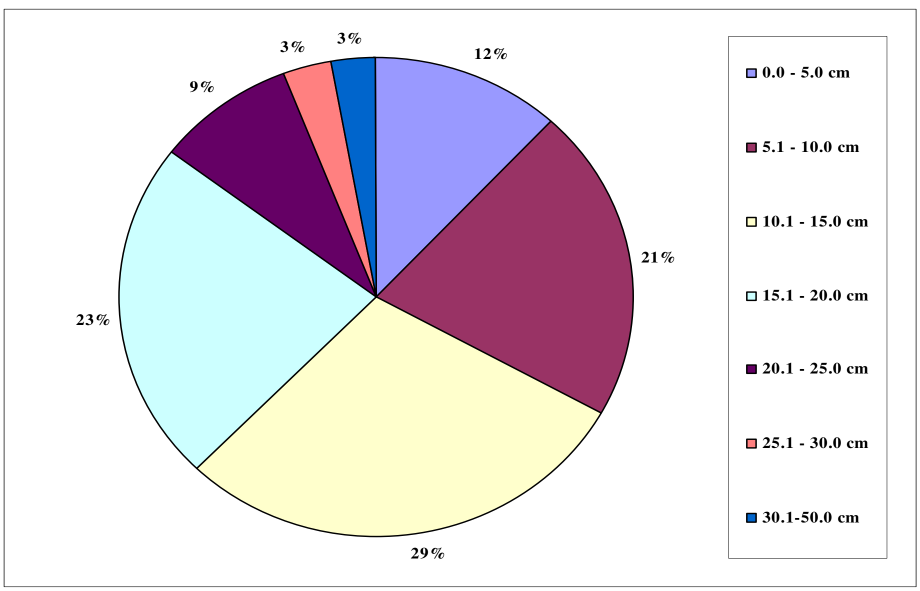

Fig. 9 The percentage distribution of the corresponding standard deviation heights size increments, for points determined by GNSS technology (fast static method) located within the massif

Analyzing the diagram in fig. 8 it is noted that the range 15,0 cm-10.1 is 29%, 15.1-20.0 cm range is 23%, 5,1-10,0 cm represents 21%, the range 0.0-5.0 cm represents 12%, from 20.1-25.0 represents 9% and 25.1-30.0 cm intervals and 30.1-50,0 cm represent 3%.

As a consequence, the points of detail inside the massive forest and positioned through the rapid static method , the planimetric coordinates are indicators of accuracy 100% which are inferior to the amount of 30 cm.

For height just a percent of 3% of the indicators of precisions exceed 30 cm.

CONCLUSIONS

It is found that the positioning of points of detail that is located in the areas occupied by forest vegetation, with GNSS technology, fast static method can be performed successfully.

The use of GPS system for positioning the various details of the forestry fund, although it is not devoted to such work, ensure appropriate outcomes from the viewpoints of the precision and accuracy, under certain conditions.

Decisive for positioning in GPS system of the various points inside or on the edge of the forest masive vegetation season of vegetation, the structural elements of stands, orography of land and access to the GSM signal.

Studies and research of position in the forestry fund details of the GPS system, through various methods have been made in autumn, winter and spring, so in the off-season of vegetation in order to eliminate the influence of the crown on a satellite signal.

Positioning details of forestry fund by fast static method ensures outcomes involving precision satisfactory, having regard to the working conditions of the land and the technical possibilities of the technology used.

As a result, the positioning details inside the forestry masive and the selvage is characterised by a high efficiency, in this case, this method draws the serious attention in order to grant due attention on the part of the technical rules in force.

The use of known points adiacent to the area will ensure that the relatively small size of vectors with positive impact on the time of positioning.

In the graticule of vectors which are processed in datum your local or regional levels, the number of known coordinates may be reduced to a minimum, something confirmed by our research.

Use the regional and local transformation is a definite possibility of obtaining precise coordinates are characterized by a high accuracy.

Compared with the total station GPS system for removing detail in the forestry or outside it does not require the network layout, which gives its indisputable advantage.

Data processing in GPS system using the TTC is characterised by high flexibility and interactivity, as a result may process your information on separate working sessions, weekdays or unit (block), provided the existence of a sufficient number of connecting points.

The results obtained from the position of forestry fund in the details of the GPS system through various methods of calculation, studied and analyzed in this study, appropriate to extend the current practice.

REFERENCES

1. Ádám J., Bányai L., Borza T., Busics G., Kenyeres A., Krauter A., Takács B., 2004, Müholdas helymeghatározás, Editura Müegyetemi, Ungaria;
2. Boş N., Iacobescu O., 2009, Cadastru şi cartea funciară, Editura C.H. Beck, Bucureşti;
3. Boş N., Iacobescu O., 2007, Topografie modernă, Editura C.H. Beck, Bucureşti;
4. Boş N., 2003, Cadastru general, Editura All Beck, Bucureşti;
5. Hofmann-Wellenhof B., Lichtenegger H., Collins J., 1997, Global Positioning System – Theory and Practice, Editura Springer Wien, New York;
6. Neuner J., Onose D., Coşarcă C., Turcanu R., 2002, Utilizarea raţională a metodelor de măsurare bazate pe sistemele de poziţionare globală în lucrările de cadastru, Revista de Geodezie, Cartografie şi Cadastru, Lucrări prezentate la Simpozionul Naţional Cadastru-Tehnologii moderne de determinare, înregistrare şi evidenţă, vol. 11, nr. 1-2, Bucureşti;
7. Neuner J., Săvulescu C., Moldoveanu C., 2002, Studiu privind posibilitatea de determinare a coordonatelor în proiecţia stereografică 1970 utilizând tehnologia GPS, Revista de Geodezie, Cartografie şi Cadastru, Lucrări prezentate la Simpozionul Naţional Cadastru-Tehnologii moderne de determinare, înregistrare şi evidenţă, vol. 11, nr. 1-2, Bucureşti;
8. Neuner J., 2000, Sisteme de poziţionare globală, Editura Matrix Rom, Bucureşti;
9. Păunescu C., Mocanu V., Dimitriu S.G., 2006, Sistemul global de poziţionare G.P.S., Editura Universităţii din Bucureşti;
10. Sabău N.C., 2010, Măsurători Terestre, Editura Universităţii din Oradea;
11. Măsurători Terestre - Fundamente, 2001, vol.I, Utilizarea Calculatoarelor Electronice, Instrumente şi Metode de Măsurare, Topografie, Note de curs pentru specializarea în Cadastru, Geodezie şi Cartografie, Ediţie îngrijită de Consiliul Facultăţii de Geodezie Bucureşti, Editura Matrix Rom, Bucureşti;
12. Măsurători Terestre - Fundamente, 2002, vol.II, Topografie Inginerească, Cadastru, Bazele Prelucrării Măsurătorilor Geodezice, Note de curs pentru specializarea în Cadastru, Geodezie şi Cartografie, Ediţie îngrijită de Consiliul Facultăţii de Geodezie Bucureşti, Editura Matrix Rom, Bucureşti;
13. Măsurători Terestre - Fundamente, 2002, vol.III, Geodezie, Fotogrametrie, Cartografie, Drept şi legislaţie funciar-cadastrală, Organizarea lucrărilor de Cadastru şi Geodezie, Note de curs pentru specializarea în Cadastru, Geodezie şi Cartografie, Ediţie îngrijită de Consiliul Facultăţii de Geodezie Bucureşti, Editura Matrix Rom, Bucureşti.