

# A New Approach to Teaching C++ Programming for Surveyors and Cartographers: Pedagogical Experiment at the Moscow University of Geodesy and Cartography

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**Key words:** Education; teaching C++ programming; training computer programs; direct angular intersection; Gauss formulae

## SUMMARY

A new approach to teaching C++ programming for surveyors and cartographers has been developed. Pedagogical experiments were carried out in the period of 2009–2020 in Moscow State University of Geodesy and Cartography. The C++ programming course focuses on the use of cartographic tasks and geodetic exercises to illustrate various programming language constructions. Students have to deal with common geodetic tasks both on lectures and during practical sessions in computer class. This is the main characteristic of the training. The examples of geodetic training programs for first-year students might be the following: determination of the height of a point on the map, calculation of a grid bearing of a line. For the purpose of training students are asked to convert an angle from a radian measure to degrees, minutes, seconds and estimate Gaussian convergence of meridians. The slope of line on the map is to be calculated; the declination of magnetic needle for old topographic map is to be evaluated. During the period of training students also work with programs theodolite and Adrianov's compass and have to program their tasks. Currently, more than fifty training programs are used in the training process. An example the typical training program for students studying the basics of programming in C++ is discussed. The program calculates the flat rectangular coordinates of the desired additional point according to Gauss formulae. The coordinates of the sought point are calculated by the coordinates of two starting points, two angles of the direction of the baselines and two adjacent angles at the base points. The developed program illustrates the calculation of flat rectangular coordinates by means of a straight single angular intersection using procedural programming technology.

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FIG Working Week 2020  
Smart surveyors for land and water management  
Amsterdam, the Netherlands, 10–14 May 2020