

A New Method to Derive Normal Height from GPS Height Based on Neural Network

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ABSTRACT

The adjusted GPS height is the height above the surface of the WGS-84 ellipsoid. In China, however, normal height, which is the height above geoid calculated using the mean normal gravity along the plumb line, is used in engineering applications. Thus, it is necessary to convert a GPS height into a normal height. Normally, the conicoid fitting method (CFM) and the neural network method (NNM) are used for this purpose. But, each of them has its own advantages and disadvantages. After studying these two methods, a new method (abbr. CFM&NNM) is conceived that combines the advantages of both the conicoid fitting (CFM) and neural network method (NNM). This paper discusses the structure of the BP neural network and detailed algorithm of the CFM, NNM and CFM&NNM method.

A practical engineering example is used to study the three different methods. In a city's D-order GPS network (about 300km²), 44 GPS points have third-order elevations obtained by geodetic leveling survey. Removing the 4 points which were found to contain gross error, the new method is tested with the rest 40 points. We take 10 evenly scattered points as a study-group to train the neural network and the other 30 points as a work-group to check the effectiveness of the trained neural network. Comparison of the three methods is discussed. After studying with the study-group, the working mean square error of the work-group is about ± 7.8 mm by CFM, about ± 6.9 mm by NNM, and about ± 5.5 mm by CFM&NNM. It is demonstrated that the combined CFM&NNM method produces better results than either the CFM or the NNM in deriving normal height from GPS height.

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TS5.2 Height Determination Questions
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