

Research on High Precision Processing Algorithm for GPS Real-time Deformation Monitoring Based on Kalman Filtering

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ABSTRACT:

Deformation monitoring plays a very important role in guaranteeing the safety of construction and operation of the building, such as dams, bridges and power stations, preventing geological disasters. With the unceasing development of deformation monitoring technology, more and more ways of deformation monitoring appears, among them, as a important technical means, GPS has been used more widely in deformation monitoring. At present, the post-processing method of GPS deformation monitoring based on session model cannot meet the real-time response of deformation in landslide, geological hazard etc. any more. With the development of communications, computer and GPS data processing methods, GPS real-time deformation monitoring technology has caught more attentions and has become a new hotspot of GPS measurement field.

Therefore, this paper discusses and analyzes the high precision data processing methods of the real-time deformation monitoring.

Firstly, the mathematical models of the double-difference and triple-difference algorithm with Kalman filtering are established and discussed, which are used to process data of GPS real-time deformation monitoring. According to the easy accumulation of rounding error in standard Kalman filtering algorithm, the paper introduces the UD decomposition filter algorithm.

Meanwhile, this paper gives the resolution method of ambiguity, and the detection and repair method of cycle slip which are key issues in data processing of deformation monitoring.

Finally, in order to analyze and evaluate the effects of the methods above, a software which adopts the algorithm above has been developed. According to the processing results and analysis of the GPS deformation monitoring data of three especial and persuasive schemes, we can draw the following conclusions that the data processing methods of GPS real-time deformation monitoring with double-difference and triple-difference Kalman filtering algorithm used in this paper is feasible and reliable. And it can not only remove the noise of real-time deformation information caused by the measurement noise of GPS signal, but also reach the high precision, that the standard deviation of east and north component are about 3 millimeter ,and that the standard deviation of height component is about 5 millimeter. In those scenes where the multipath effect is very severe and needs to be taken into account carefully, triple-difference Kalman filtering algorithm is better than the double-difference algorithm, because the later can significantly eliminate systematic multipath error by the difference between the adjacent epochs.

In addition, some recommendations are given for further research.