Research on some research about move relative positioning techniques and method

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Abstract. The passage is based on the analysis of the traditional processing technology about GNSS relative positioning, in view of the practical orientation of high dynamic, real-time requirements, the passage set up move relative positioning model, and put forward the simulated dynamic test such as car test verification. Finally, through the analysis of process data move difference relative positioning and algorithm it verified the reliability and validity. The passage realized the high precision index of relative positioning.

1. Introduction

In high dynamic relative positioning, GNSS carrier phase difference technology can achieve the role of improving positioning accuracy. We can install a receiver the dynamic base station and rover, the receiver on the rover point to track the satellite signal, with the information the signal from the base station's receiver carrier to calculate in processing, under the premise of calculating right ambiguity, then, we can get accurate relative position between base station and rover. Unlike general situation, the base station coordinates like rover coordinates real-time change, to achieve ambiguity in real-time single epoch, we must analyze the problem in this case.

2. The GNSS relative positioning

For example, as the short baseline, with double difference model is given priority to, after a double difference, can eliminate the troposphere and ionosphere, multipath effects, simplified model is:

$$\begin{cases} \nabla\Delta \mathrm{R}_{\mathrm{br}}^{\mathrm{jk}} = \nabla\Delta\rho_{\mathrm{br}}^{\mathrm{jk}} + \nabla\Delta\varepsilon_{\mathrm{br,R}}^{\mathrm{jk}} \\ \lambda\nabla\Delta\phi_{\mathrm{br}}^{\mathrm{jk}} = \nabla\Delta\rho_{\mathrm{br}}^{\mathrm{jk}} + \lambda\nabla\Delta \mathrm{N}_{\mathrm{br}}^{\mathrm{jk}} + \nabla\Delta\varepsilon_{\mathrm{br},\phi}^{\mathrm{jk}} \end{cases} \tag{1}$$

Among them, Type, j, k respective different visible satellite, b and r respective base station and rover, ε respect multiple path noise.

Due to the high dynamic positioning process, whether it's rover or relative rover vehicle are in motion, for calculating static circumstances more epoch ambiguity method cannot meet the demand of fixed, the second after the satellite signal affected cause cannot quickly fixed ambiguity, must find other ways to solve the problem. On the basis of the traditional solution method, concrete can be realized through the following two steps for calculating ambiguity, to obtain a high precision floating point, second set up a quick search method of ambiguity resolution. In this paper, proposed a step-by-step elimination method to determine the ambiguity.

$$\begin{bmatrix} A^{\mathrm{T}}C^{-1}A & A^{T}C^{-1}\mathrm{B} \\ \mathrm{B}^{\mathrm{T}}\mathrm{C}^{-1}\mathrm{A} & \mathrm{B}^{\mathrm{T}}\mathrm{C}^{-1}\mathrm{B} \end{bmatrix} \begin{bmatrix} \mathrm{X} \\ \mathrm{N} \end{bmatrix} = \begin{bmatrix} \mathrm{A}^{\mathrm{T}}\mathrm{C}^{-1}\mathrm{L} \\ \mathrm{B}^{\mathrm{T}}\mathrm{C}^{-1}\mathrm{L} \end{bmatrix} \tag{2}$$

On the type, X as the baseline vector, $N_{\alpha\beta}$ as the combination of double difference ambiguity vector, A, B as coefficient matrix respectively, and C^{-1} as weight matrix. According to the coefficient of combination, have established under type:

$$\varphi_{\alpha\beta} = \alpha\varphi_{\mathrm{L1}} + \beta\varphi_{\mathrm{L2}} \tag{3}$$

After the combination phase, $N_{\alpha\beta}$ can be determined according to the least squares method, because α , β as only one set of coefficient. The mathematical relationship is unable to correctly solve their ambiguity, so if any search for a new set of coefficients as η , γ , as the type of combination, in accordance with the following combination equation of solving ambiguity and correctly. After solving the ambiguity, also can according to (2) the solution of the baseline vector.

$$\begin{bmatrix} N_{\alpha\beta} \\ N_{\eta\gamma} \end{bmatrix} = \begin{bmatrix} \alpha & \beta \\ \eta & \gamma \end{bmatrix} \begin{bmatrix} N_1 \\ N_2 \end{bmatrix} \tag{4}$$

3. Test

Positioning mode to GPS receiver/BDS integrated positioning, the satellite by the altitude Angle is set to 15 °during the trial, data update frequency set of 1 Hz. At the beginning of the test, the rover cars carrying antenna static, static positioning about 20 minutes, then push the car running several circuits of the track. Base station antennas fixed on the tenth floor on the roof of the car, moving around the deck. In the process of the whole test, two station receiver respectively continuous acquisition and maintenance of satellite data.

During the trial, the use of the algorithm is compiled to collect real-time data processing in test respectively for each epoch GPS and BeiDou baseline as a result, the trajectory and baseline length change results are obtained.

Below is for collecting data processing after the rover trajectory, among them, the red BDS calculating result, green said GPS calculating results.

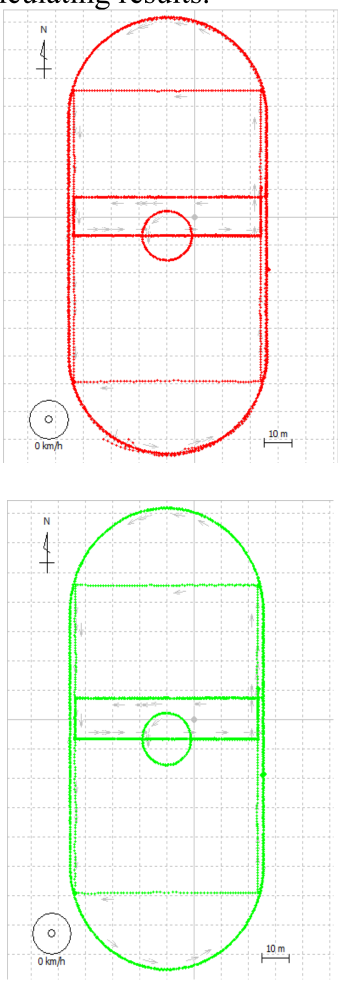

Figure1. rover trajectory graph (GPS: left; BDS right)

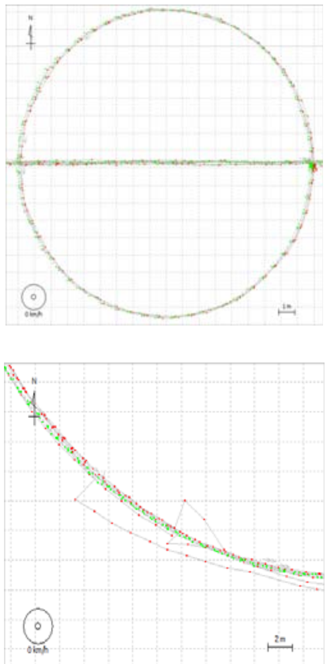

Figure2. BDS compared with GPS trajectory

Can be seen from the diagram above, GPS and BDS track almost overlapping. Zoom in on the right side of figure area, a few epochs of hops, compared with the real trajectory deviation about 2 m. Through the analysis of the causes of this deviation is probably track surrounding buildings and trees affected the satellite signal increases, the multipath errors caused further cause the fluctuation of the filtering results.

4. Conclusion

By studying the observation error of mean square error and OVT inspection epoch influence on success rate for calculating ambiguity, can draw the whole week, calculation of ambiguity, the success rate by pseudorange double difference observation error the influence degree of the mean square deviation value change is bigger. And by increasing the OVT inspection epoch number, can effectively improve the success rate for calculating ambiguity. As a result, the fuzzy degree of decoding process, can effectively improve the success rate of calculating with this method.

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