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THE STUDY OF GPS AMBIGUITY RESOLUTION ON THE FLY

Abstract

In high precision relative navigation, the second receiver is in permanent motion and after a loss of lock, the amtiguities should be fixed instantaneously as real time positioning results are required. In order to achieve an acceptable precision level(typically 1-2 cm for up to 10 Km baselines),one has to constrain the ambiguity parameters to their integer values. The estimation of these values has proven to be a particularly hard and time consuming problem.

Critical in the ambiguity resolution is the speed and quality of the computed integer ambiguities.Nowadays,GPS ambiguity resolution is usually based on the integer least-squares principle. In Teunissen(1993),it was shown that the DD ambiguities are strongly correlated, especially when the observational time span is short.By constructing a decorrelating transformation for the ambiguities, the existing large correlation between the ambiguties is reduced to a great extent.The usuall transformation matrix is the Z-transformtion matrix. The Z-transformtion matrix is required to be integer and volume preserving. Thus it can not make the float ambiguities variance covariance matrix be an identity matrix,at the same time, it is a time consuming task to obtain the Z-transformation matrix.

In this paper an ambiguity resolution algorithm of the double-difference carrier phase is presented. The algorithm uses double-differential carrier phase observation and double-differential pseudorange smoothed by double-differential carrier phase to establish observation equations, these equations make the float ambiguities more accurate; In the first step, the algorithm aims at making float ambiguity decorrelation completly, the float transformation matrix was acquired by Cholesky factorization,this transformation matrix is volume preserving,but not integer preserving,it makes the float ambiguities variance covariance matrix be an identity matrix. By the completely decorrelation, the integer estimation can be carried out very fast and efficiently; In the second step, the integer minimization problem is then attacked by a discrete search. By using the criterion of minimum baseline residual, the integer ambiguities candidates of one epoch are fixed. In the third step,the algorithm checked up the integer ambiguity candidates in different epoch by OVT(over-the-time) method,if the integer ambiguity candidates of different epoch of a certain time spain are identity,then the integer ambiguity are fixed.

Experiments indicate that the algorithm can meet the requirement of kinematic precision.For baselines up to 10 Km,the method is able to come up with the correct integer estimates at a high success rate using only one epoch of data. These results show that the method enables instantaneous ambiguity resolution and is therefore very well suited for real-time precise navigation.