CYCLE SLIP DETECTION IN KINEMATIC GPS BASED ON A JERK MODEL FOR LAND VEHICLES

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The present thesis proposes a dynamical model which is adequate for cycle slip (i.e., sudden jumps in the carrier phase observation due to an integer number of cycles) detection in kinematic Global Positioning System (GPS). Kinematic GPS estimates the position and velocity by using dynamical models, but cycle slips decrease the accuracy of the position and velocity. The cycle slip detection method using innovation (i.e., the difference between observation and predicted value of observation) is effective at maintaining the high accuracy. However, the accuracy of the predicted position and velocity decreases if the dynamical model is not appropriate for land vehicle movement. In this case, when the methods statistically test whether cycle slips occur, using the innovation, the inadequate dynamical models cause the mis-detections of cycle slips. To prevent these mis-detections, the thesis proposes a dynamical model in which the jerk is assumed to be a first-order Markov process (called as a jerk model), and demonstrates that the jerk model fits the vehicle movement. It is therefore necessary to show that the time series data in different time intervals fit the same jerk model, i.e., that the jerk model is a stationary autoregressive model. The thesis proposes a method that decides whether the autoregressive model is stationary. The stationarity of the jerk model is analyzed by using observation data collected with a car. Moreover, the cycle slip detection performance of the jerk model is compared with that of another model, and it is shown that the performance of the jerk model is improved.