Clock Bias Prediction by Application of Variational Bayesian Adaptive Kalman Filter

Chen-Dehao[1,2], Yi-Hang[1,2], Li-Ang[1,2], Li-Dandan[1,2], Yang-Huijun[1,2], Wang-Xueyun[1,2]

[1]Beijing Institute of Radio Metrology and Measurement, Beijing 100854 China
[2]Science and Technology on Metrology and Calibration Laboratory, Beijing 100854 China

Email: chendehaomail@163.com

The Kalman filter has the characteristics of recursive optimality and linear least mean square, which is widely used in the clock bias prediction of laboratory atomic time scale control, and also has important applications in the prediction of satellite clock bias and the prediction of receiver clock bias. However, under the action of typical Kalman filter, when the observation data generates non-Gaussian noise due to environmental interference, the estimation accuracy of the system decreases significantly.

In order to improve the performance of the traditional Kalman filtering algorithm in clock bias prediction, this paper proposes to apply the variational Bayesian adaptive Kalman filtering algorithm to achieve clock bias prediction. This method aims at the shortcomings of the need for an accurate observation noise model in the effective application of traditional Kalman filter, the observation noise model is selected as the inverse Wishart distribution, and the variational Bayesian method is used to iteratively estimate the system state and observation noise covariance, which is applied to Kalman filter to improve the adaptive ability of Kalman filter clock bias prediction.

The simulation results show that compared with the traditional Kalman filter, the prediction accuracy of applying the variational Bayesian adaptive Kalman filter for clock bias prediction is improved to a certain extent. This provides a new application idea for clock bias prediction based on Kalman filter.