Abstract

Mohamed E.Tamazin

Robust fine acquisition algorithm for GPS receiver with limited resources

The signal acquisition stage of a GPS receiver detects GPS satellites in view and provides coarse estimate of the GPS signal Doppler frequency shift and code delay for use by the tracking loops. The accuracy of the signal acquisition has a direct influence on the tracking performance. The implementation of a GPS signal acquisition algorithm requires compromising between acquisition frequency resolution improvement and reduction in acquisition time. A robust fine acquisition method is proposed to acquire the carrier frequency accurately after the completion of the coarse acquisition of the GPS signals. The proposed method uses Gram-Schmidt orthogonalization to provide robust spectral estimation of satellite Doppler frequency with less computational time. The proposed method starts after the coarse acquisition has been accomplished. The C/A code phase is striped off from the carrier signal. Then, sinusoidal candidate functions are generated at each of the frequencies range of interest, which is typically set around the estimated Doppler shift acquired from the coarse acquisition stage. Finally, an orthogonal search algorithm is utilized to detect the carrier frequency accurately. The performance of the proposed method is evaluated against of the computational load and the effects of the noise. Its performance was also compared to the state-of-the-art FFT and zero-padding FFT-based fine acquisition algorithms. The simulation and experimental results show that the proposed method outperforms existing methods and has sufficient acquisition accuracy for its application in the real world.