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» Abstract

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Category	Signal Interference and Multipath
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Title of the Paper	GPS Multipath mitigation using discrete wavelet transforms
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Abstract	<p>Once the satellite signals reach the earth's surface, ideally they enter the antenna directly. However, objects in the receiver's vicinity may reflect some signals before they enter the antenna, causing unwanted signatures in pseudorange and carrier phase observations. Although the direct and reflected signals have a common emission time at the satellite, the reflected signals are always delayed relative to the line-of-sight signals because they travel longer paths. The amplitude (voltage) of the reflected signal is always reduced of attenuation. The attenuation depends on the properties of the reflector material, the incident angle of the reflection, and the polarization. In general, reflections with very low incident angle have little attenuation. In addition, the impact of multipath on the GPS observables depends on the sensitivity of the antenna in terms of sensing signals from different directions, and the receiver's internal processing to mitigate multipath effect. So multipath is still one of the dominating, if not the dominant, sources of error in GPS positioning.</p> <p>Different methods are used to solve multipath effect. In this paper beside of reviewing existing methods, a new method is presented. In this new method wavelet transform is used for multipath detection and reduction from GPS phase observables. Most important advantages of wavelet transform are as follows: This method doesn't require initial values, it's filtering is simple, against Fourier transform this method is able to represent a signal in the time and frequency domain at the same time, and also, because of wavelet transform is a multi resolution analysis, it can overcome to window function definition problem in short time Fourier transform. Nevertheless, disadvantage of wavelet transform is that some useful data of signal during the transform will be removed. In numerical experience section of this paper, signal is double differential phase observations, which is input for wavelet transform analysis. The other input is the mentioned signal that in which multipath is simulated. Obtained results show the ability of wavelet transform in multipath detection and reduction from GPS observables. Multipath identity is exhibited at a certain scale in the decomposition and the double differential observation is then reconstructed by a filtering to the signal with multipath eliminated. Denote that by increasing the number of Filtering levels, we may miss some useful parts of signal. In this study we develop ISUN package for different processes in GPS data analysis.</p>
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