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HIGH EARTH ORBIT NAVIGATION BY VECTOR TRACKING

Abstract

Since the first attempts to reach HEO (High earth orbit), most of space vehicles use INS, remote measurement and ground stations as their navigation system but recently there is a tendency to use automatic systems such as GNSS because of its maturity, accuracy and low facilities needed on vehicle. Signal level and dynamics are the most difficulties of GNSS in HEO which can be solved by vector tracking method. Despite scalar tracking receivers that track signals in each channel independently, receivers implemented by vector tracking use a Kalman filter to gather information from all channels and track it together. Another difference is that in Scalar tracking method, navigation solution and signal tracking are performed separately whereas in vector tracking a Kalman filter combines these tasks into a single algorithm. Reported simulations prove that in noisy and high dynamic conditions, vector tracking has better performance than scalar tracking. In this paper the requirements of GNSS signal strength in HEO and the feasibility of using vector tracking is studied through covariance analysis. It is shown that if the tracking threshold is set about 14 dBHz, in 97% of a whole day at least 4 satellites are traceable, and also shown that in vector tracking method, signal level of 14 dBHz is achievable, whereas in scalar tracking it cannot be better than 20 dBHz.