Paper ID: 87809
student

IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
Interactive Presentations - IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (IP)

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ATTITUDE DETERMINATION WITH GPS CARRIER SMOOTHED CODE PHASE MEASUREMENTS AND KALMAN FILTERING

Abstract

Attitude determination is crucial for navigation in robotics, aerial and space applications. Conventionally attitude sensors achieve the purpose, however, GNSS measurements offer a cheaper and reliable alternative. This paper presents a novel approach for improving the accuracy of attitude angle estimation by Kalman filtering using GPS carrier smoothed code phase measurements. The measurements are acquired in differential configuration using four u-blox single frequency receivers, while synchronizing their time, with one receiver acting as the base. The position of base antenna is determined using single point positioning and baselines are determined. Attitude angles are computed both by direct attitude computation and Kalman filtering approach. Through empirical studies and comparative analyses, the effectiveness of the proposed approach is evaluated against traditional carrier phase-based methods. Results demonstrate that after applying the Kalman filter, the attitude angles derived from carrier smoothed code phase measurements exhibit comparable accuracy to those obtained from carrier phase-based methods. This research contributes to advancing the field of attitude determination by offering a viable alternative to traditional carrier phase-based methods. The proposed approach provides a pathway for achieving accurate attitude angle estimation using cost-effective u-blox single frequency receivers, thereby expanding the accessibility of high-precision navigation solutions.