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Error compensation of single-antenna attitude determination using GNSS for Low-dynamic applications

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GNSS-based single-antenna pseudo-attitude determination method has attracted more and more attention from the field of high-dynamic navigation due to its low cost, low system complexity, and no temporal accumulated errors. Related researches indicate that this method can be an important complement or even an alternative to the traditional sensors for general accuracy requirement (such as small UAV navigation). The application of single-antenna attitude determining method to low-dynamic carrier has just started. Different from the traditional multi-antenna attitude measurement technique, the pseudo-attitude attitude determination method calculates the rotation angle of the carrier trajectory relative to the earth. Thus it inevitably contains some deviations comparing with the real attitude angle. In low-dynamic application, these deviations are particularly noticeable, which may not be ignored. The causes of the deviations can be roughly classified into three categories, including the measurement error, the offset error, and the lateral error. Empirical correction strategies for the formal two errors have been promoted in previous study, but lack of theoretical support. In this paper, we will provide quantitative description of the three type of errors and discuss the related error compensation methods. Vehicle and shipborne experiments were carried out to verify the feasibility of the proposed correction methods.

Keywords: Error compensation; Single-antenna; GNSS; Attitude determination; Low-dynamic