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Orbit determination and thrust force modeling for a maneuvered GEO satellite using two-way adaptively Kalman filter

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Geostationary (GEO) satellite commonly plays as relays to transmit messages or signals for space-based augmentation system. If a GEO satellite is used for navigation such as Chinese Compass Navigation System, the orbit information should be continually broadcasted to the users for the navigation and positioning computation. In order to keep the GEO satellite staying in its "fixed" position, satellite maneuver is regularly performed in weekly or two weekly. It brings a great challenge for precise orbit determination of GEO satellite. In this paper, a two-way adaptively Kalman filter is proposed for orbit determination and thrust force modeling of GEO satellite. The adaptive factor is determined based on predicted residuals for balancing the contributions of the measurements and the dynamic information. The main procedure of the proposed method is as follows. Firstly, the whole acceleration including thrust force is determined by using a forward adaptively Kalman filter, and the acceleration without thrust force can be obtained by dynamic models computation. Secondly, the difference between these two types of accelerations is used to model the thrust force in the form of linear or quadratic polynomial. Finally, the modeled thrust force is included in satellite dynamic model and a backward adaptively Kalman filter is performed. Simulations were conducted to verify the performance of the proposed orbit determination technique. The results show that it can provide a reliable, high accuracy for orbit determination and thrust force modeling of GEO satellite.