عنوان مقاله:

Kinematic velocity determination for the low-Earth-orbit satellites using the extended Kalman filter: a case study, the GRACE twin satellites

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خلاصه مقاله:

Global Positioning System (GPS) receivers in gravimetric satellites continuously measure valuable information about ۳D satellite position. However, the velocity of satellites, which has important applications in the satellite geodesy such as gravity field recovery, cannot be directly measured. These data are used in the energy integral method or other methods based on the Earth gravity field motion equation to determine the velocity or acceleration of satellite. In this study, the velocity vector is computed using the numerical differentiation and the Kalman filtering for the Gravity Recovery And Climate Experiment (GRACE) twin satellites. The Numerical results show that the Kalman filtering yields more accurate results than numerical differentiation when they are compared with the intersatellite range-rate measurements. In the wake of the New Gravity Satellite era due to the launch of ChAllenging Minisatellite Payload (CHAMP), GRACE and GOCE, processing methods of enormously large orbit data has become the focus of the geodetic interest. The input data are different from earlier times as they contain some millions of continuous position data per satellite per year. The huge number of data arises from continuous observation from these satellites to the GPS system. This can be done due to the much higher altitude of the GPS satellites (۲۰,۰۰۰ km) compared to that of the gravity satellites (between ۲۵۰ and ۵۰۰ km). The latter is often referred to as Low Earth Orbiter, i.e. LEO. The GPS-LEO constellation as described above in technical terms is called High-Low Satellite to Satellite Tracking (High-Low SST). Thus some million position-data of the LEOs are the basis of the global gravity field determination techniques. The concept behind the Solutions is that satellites are in free-fall in the gravity field of the Earth. After modeling and removing all further force sources (e.g. gravitation of the Sun and the Moon and other planets, direct and indirect tides, surface forces (atmospheric drag, solar radiation pressure)) the remaining orbit is a trajectory in space, which is governed purely by the gravity field of the Earth. Therefore, the task is only to determine the force behind the motion. Conservation laws can be applied for satellites successfully. The Newton’s equation of law states the conservation of forces in a closed system. Applying it for a satellite requires information of the acceleration along the orbit. In this article the velocity vector is derived as a part of the unknown vector in Kalman filter algorithm. Kalman filter is a well-known mathe ...

کلمات کلیدی:

ماهواره های مدار پایین, میدان گرانش زمین, سامانه فاصله یابی باند K, فیلتر کالمن تعمیم یافته, مشتق گیر عددی