Covariance Analysis of Two Spacecraft System Using Relative Line of Sight Vector Measurements

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Autonomous orbit navigation of a pair of Earth-orbiting system is considered with the relative line-of-sight vector measurements between two spacecraft system. Numerical observability analysis of the system with the available measurements using the linear observability analysis and the relative state variable observability were presented in the Spring Conference, 2004. In this presentation, analytical observability analysis is dealt with the same relative line-of-sight vector measurements. Furthermore, covariance analysis based on the batch filter is investigated with the various orbit configuration, and with a representative case, another covariance analysis based on the extended Kalman filter is considered in order to infer the filter performance with solely the initial state error and the measurement error using the relative line of sight measurements. For measurement frequency, the final time covariance error and the mean covariance error show that the more frequent measurement update gives the state estimate more accuracy. For measurement accuracy, the estimation accuracy directly depends almost linearly on the accuracy of the relative LOS vector measurements. The covariance errors at final time show that the position can be determined with an accuracy of about 50 m and the velocity about 1 m/sec.