IAF ASTRODYNAMICS SYMPOSIUM (C1)
Guidance, Navigation and Control (1) (1)

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AUTOMATED GUIDANCE AND NAVIGATION FOR RENDEZVOUS AND DOCKING OF SPACECRAFT USING SDRE CONTROLLER AND UKF ESTIMATOR.

Abstract

Rendezvous and Docking process is one of the major issues in autonomous Navigation and Guidance of spacecrafts, due to various constraints and limitations. The tracking control required to to determine the forces to dock the chaser spacecraft to the target spacecraft is very complex. In addition, one of the prime requirements of low impact docking is to obtain the precise relative position and relative attitude information of the chaser with reference to target. In this paper, it is assumed that spacecraft uses Video Sensor which is capable of providing measurement for relative position and relative attitude as the navigation measurements in a co-operative target. The relative position dynamics of the spacecraft are based on Tschauner and Henpel (TH) equations where elliptical orbits are considered to improve the model accuracy. In this research work, Unscented Kalman Filter (UKF) is used to estimate relative position and relative velocity, to achieve better estimates without compromising accuracy and computational effort. The paper will implement position trajectory control using State Dependent Riccati Equation (SDRE) and PID based attitude control in closed feedback loop to achieve soft docking of the spacecrafts.