IAF ASTRODYNAMICS SYMPOSIUM (C1)
Interactive Presentations - IAF ASTRODYNAMICS SYMPOSIUM (IP)

Author: Dr. Antonio Fulvio Scannapieco
Cranfield University, United Kingdom

Dr. Luke Feetham
Cranfield University, United Kingdom
Ms. Mónica Estébanez Camarena
Cranfield University, United Kingdom
Dr. NABIL AOUF
United Kingdom

SPACE-ORIENTED NAVIGATION SOLUTIONS WITH INTEGRATED SENSOR-SUITE: THE I3DS H2020 PROJECT

Abstract

In all orbital applications, such as on-orbit servicing and repair, rendezvous and docking, active debris removal (ADR), and planetary applications, such as exploration of unknown environments for scientific purposes by means of rovers, GPS-denied navigation aspects have a very large impact on the successful outcome of missions. Having a sensor suite, and hence several different sensors, also requires, at the same time, a suite of navigation algorithms able to deal with different kinds of inputs. Some of them, however, can be shared between multiple sensors, after thorough pre-processing of the raw data. Additionally, the same kind of sensor can require two different navigation algorithms depending on the scenario. The work described in this paper aims to present and critically discuss the approach to precise relative navigation solutions with a complete suite of sensors and their performance in different space-oriented application scenarios.

Standalone navigation filters are examined. In the case of a high-resolution camera for an orbital scenario, the pose of a target, with respect to a chaser, can be thoroughly obtained with the aid of fiducial markers. Stereo camera-based navigation is also addressed with visual odometry. In the case of a stereo camera the problem of scale estimation during odometry is solved by means of triangulation. Since the outputs of the sensor-suite are also dense 3D point clouds, Iterative Closest Point and Histogram of Distances (HoD) with Kalman filter approaches are analyzed, paying attention to the provision of correct sensor characterization. The results for each filter are exhaustively examined, highlighting their strengths and the points where some improvements can be achieved.