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Algebra for a Space Flight Algorithm

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Abstract

We have developed a navigation function for a nanosatellite probe to autonomously fly in deep space. A need is to process uncertainties on-board to select the best accessible measurements to be considered for the autonomous location determination. The main algorithm uses the directions of several celestial objects of the solar system in front of distant stars. A rough position estimate is determined by problem inversion and filtered with a linear Kalman filter, then the process is repeated. Covariances of the measured directions, that are object-dependant, are propagated through the process. We simulated a deep-space cruise from Earth to Mars. The estimated location reaches a 1-σ precision of 200 km. The performance is mainly limited by the strategy of selecting the celestial objects to be measured. Indeed, the ability to gather object directions depends on the sensitivity and agility of the probe and on the availability of objects to be observed. Comparing realistic and purely notional geometries of objects, we expect that an improvement factor up to 10 is still accessible, providing a detailed analysis of the problem's Jacobian. This approach will be further developed into an on-board algorithm to decide on-the-fly the best next object to be measured, as we could take advantage of the many asteroids in all directions of the ecliptic plane.

I. Introduction

As requested by UQOP 2019, only the abstract is provided before 12/2018. The 2-page full paper will be updated in case of selection of the abstract.

II. Methods

The methods are:
- method 1
- method 2
- method 3

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Figure 1: *Example figure*

III. Results

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Table 1: *Example table*

Name		
First name	Last Name	Grade
First name	Last Name	7.5
First name	Last Name	2

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$$e = mc^2 \tag{1}$$

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References

[Segret et al., 2019] Segret, B., Hestroffer, D., Quinsac, G., Agnan, M., Vannitsen, J., Mosser, B. (2019). Optimizations of Autonomous Orbit Determination for a Deep-Space CubeSat. (in press) *18th Australian Aerospace Congress, 24-28 February 2018, Melbourne*, ISSFD 2019.