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Post Mission Disposal and Space Debris Removal 1 - SEM (5)

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CUBESAT ONBOARD ALGORITHM FOR SPACE DEBRIS MOTION DETERMINATION BY
PROCESSING STEREO IMAGES

Abstract

Nowadays there is a real threat of access to outer space due to excessive space debris. Therefore, the problem of cleaning space from these fragments, especially from large-format, is urgent. Such kinds of missions are assumed a rendezvous with space debris, which are noncooperative objects. A preliminary study of the fragment's motion parameters is required in the case of these maneuvers with space debris. In this case, methods of stereo photogrammetry are very perspective because they involve obtaining characteristics of objects by processing stereo images (Tweddle, 2011; Aghili, 2012). However, the major disadvantages of such methods are their computational complexity and impossibility of linking two measurements that were conducted at consequence moments of time. At this moment, the possibilities of using CubeSat-class nanosatellites in similar missions are increasingly being studied. These nanosatellites are cheap through a high level of unification and standardization of on-board systems, as well as a short development time. Nevertheless, the small size of such devices imposes significant restrictions on the observation equipment and on the computational complexity of the algorithms, since the task must be solved on board of the nanosatellite. This study presents a solution to the problem of determining characteristics of the movement of space debris using a nanosatellite with video equipment, which allows making stereo images. An original algorithm that uses stereo images was proposed. It is based on the principles of triangulation and uses a pair of sequentially conducted simultaneous stereo images to determine spatial orientation.