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Development of Star Image Simulator for Star Tracker Algorithm Validation

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Abstract : A successful satellite mission in space requires a reliable attitude and orbit control system to command, control and position the satellite in appropriate orbits. Several sensors are used for attitude control, such as magnetic sensors, earth sensors, horizon sensors, gyroscopes, and solar sensors. The star tracker is the most accurate sensor compared to other sensors, and it is able to offer high-accuracy attitude control without the need for prior attitude information. There are mainly three approaches in star sensor research: digital simulation, hardware in the loop simulation, and field test of star observation. In the digital simulation approach, all of the processes are done in software, including star image simulation. Hence, it is necessary to develop star image simulation software that could simulate real space environments and various star sensor configurations. In this paper, we present a new stellar image simulation tool that is used to test and validate the stellar sensor algorithms; the developed tool allows to simulate of stellar images with several types of noise, such as background noise, gaussian noise, Poisson noise, multiplicative noise, and several scenarios that exist in space such as the presence of the moon, the presence of optical system problem, illumination and false objects. On the other hand, we present in this paper a new star extraction algorithm based on a new centroid calculation method. We compared our algorithm with other star extraction algorithms from the literature, and the results obtained show the star extraction capability of the proposed algorithm.

Keywords : star tracker, star simulation, star detection, centroid, noise, scenario
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