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A LIGHT WEIGHT ROBOT ARM FOR CAPTURING SPACE DEBRIS

Abstract

Since the number of satellites in Earth orbit is steadily increasing, space debris will eventually pose a serious problem to near-Earth space activities and so effective measures to mitigate it are becoming urgent. Equipping new satellites with an end-of-life de-orbit or orbital lifetime reduction capability could be an effective means of reducing the amount of debris by reducing the probability of the collisions between objects. On the other hand, the active removal of space debris and the retrieval of failed satellites by spacecraft are other possible measures. The Tottori University is studying a micro robotic satellite with a simple light weight robot arm for active space debris removal. The upper stages of H series rocket were selected as target debris objects to remove. It is because many rocket upper stages remain on the low earth orbit, the form and size have gathered in general, so H rocket upper stages are removable by the common technique. Capture is an indispensable task for the active removal of large space debris. In general space debris objects do not possess convenient features like target markers — they are non-cooperative targets. In this case, since the conditions are not favourite, measurement of their position for navigation guidance to approach to them is not easy. This paper first describes the details of a proposed active space debris capture/removal light weight robot arm and its vision system for optical navigation. This paper proposes a simple light weight robot arm for capturing of a debris and a stereo vision system for tracking on capturing the target by the robot arm. And this paper presents the results of feasibility studies, the performance assumed at each step, prototyping of robot arm and image processing system and experiment results also. Finally, we introduce control technologies for capturing a large debris object.