

15th IAA SYMPOSIUM ON SPACE DEBRIS (A6)  
Interactive Presentations (IP)Author: Mr. NGUYEN BA THANH LONG  
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Kumamoto University, JapanEXPERIMENTAL STUDY ON LODGING AN ANCHOR TO FREE-FALLING TARGET FOR SPACE  
DEBRIS MITIGATION**Abstract**

An experimental system for lodging of metal anchor to free falling target has been developed and the lodging behavior has been investigated. A lodging using metal anchor is a good candidate for docking of space debris mitigation systems such as electrodynamic tether system or propulsion system to space debris because this method is one of the simplest method. In the method, a tethered anchor is fired to a satellite structure and a space debris is captured by using it. Several studies have been conducted on tethered anchors in recent years. In these studies, a metal anchor is fired to a satellite structure simulated test plate fixed to the test platform to evaluate the projection velocity and docking state. However, in the real mission, the target is not fixed and the motion and momentum of target may be changed after the impact with the metal anchor. Therefore, it is necessary to consider the movement of the target after impact. Therefore, in this study we developed an experiment system which allow to conduct experiment with free-falling targets. In this system, electromagnets and an optical sensor are used to make the target from fixed state to free-falling state. First, the test plate is fixed by two electromagnets mounted on the fixed platform. When the metal anchor is fired and passes through the optical sensor mounted on the acceleration tube, the current is cut off and the magnetic force of electromagnets is lost, so the test plate starts falling. Therefore, metal anchor impacts with test plate while test plate falling. The experiment were conducted by using this experiment system. Experiment results show that the adequate docking state can be achieved with appropriate projection velocity even if a target is not fixed (in free-falling condition). The penetration velocity of non-fixed target is larger than that of fixed target and the penetration velocity increases with increasing distance from the impact position to target's center. Besides, when impact position is not target's center, the target rotates after the impact with the metal anchor.