
ABSTRACTS (MASTER THESIS)

Study on feasibility of debris removal method by laser

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Currently, there are numerous space debris around the Earth. Space debris are artifacts such as discarded satellites, rockets damaged by an accident and small pieces generated by a collision. Observable debris from the ground exists more than 20,000. The number of debris smaller than 10 cm are estimated to be more than tens of millions. Those debris are difficult to be observed from the ground. Debris are moving at a very high speed of about 7 - 8 km/s. Even small debris hit the satellite directly, there is a risk of serious damage. For this reason, research on debris removal method have been progressed. As one of them, removal method by laser ablation has been studied. Laser ablation is a phenomenon that the part of an object spurts out as plasma when it is irradiated with a strong laser beam. In this way it is possible to change the speed of an object, it is expected to be applied as a debris removal method. In the previous study, the project is proposed that putting a satellite into orbit with an optical observation device and laser irradiation device. The system will detect debris which is difficult to observe from ground and remove the debris by laser irradiation. However, debris removal effect is not considered in detail. Thus in our study, we construct the orbit simulation of a satellite and debris. We evaluated debris removal effect of the method by the simulation.

We perform simulation about existing debris and debris fragment, and investigated the effect of remediation for various debris orbital plane. As a result, we found that it is possible to remove 2% of all debris for 4 week simulation. It mean that we can remove more than 20% of debris around the Earth for 1 year. From this fact, we can conclude that our proposing method using laser ablation is effective for debris remediation around the Earth.