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A NOVEL DEGENERATION AND DEORBITING TECHNIQUE FOR SPACE DEBRIS REMOVAL

Abstract

The space race has taken a giant leap since the launch of the very first satellite. After that, to revolutionize this sector, hundreds of satellites have been launched every year. This results in the increase of space junk. It has become a serious concern in the space sector, leading to many major problems like increased probabilities of collisions, space traffic, and problems for astronomical researchers. Statistically, there are more than 23,000 pieces of debris larger than 10 centimeters traveling at speeds up to 17,500 mph, fast enough to cause severe damage to a satellite or a spacecraft. More than half a million pieces of debris larger than 1 centimeter, and approximately 100 million pieces of debris of about 1 millimeter floating in free orbits. This paper proposes a proactive and novel technique that can work as a great solution to the rising space junk problem to counter the problem. This process entirely relies upon solar radiation without any external energy aid making it unique. The mechanism consists of a series of medium-sized liquid lenses that converge the incident solar radiation to a point on the space debris to be degenerated due to the force created by solar radiation in the form of radiation pressure. The lenses are made with transparent elastic material, which can be deformed to any lens shape with varying thickness at the center, thereby controlling the combined focal length by changing the thickness of the lenses with different volumes and types of refractive liquids used. The lenses can be activated with the help of electro-valves resulting in increased energy efficiency. The setup will be able to degrade the space debris present lower to its orbit and the resulting reaction forces on the satellite can be balanced by the satellite's own Attitude Determination and Control System (ADCS). The objective can be achieved by maintaining the minimal relative velocity with the small concerning debris and can also be used for the bigger sized targets by manipulating the force parameters. There are numerous applications to this solution in the space debris removal sector, and further research can help in better power-size efficiency so that it can be implemented in future space missions for effective protection from such space hazards.