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# Using Solar Sails to stabilize orbits around asteroids with irregular gravitational fields

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The exploration and study of asteroids has been triggering an increasing interest in the space community. The study of asteroids scientific purposes relies on the wide range of information they contain about the origin of planets and life. They also present an interesting economic perspective when considering the possibility of space mining, given that they present a great amount of rare metals and mineral resources in their compositions in many cases. Some of these bodies, known as Near-Earth Asteroids, also present a threat to life on Earth. Their trajectories exhibit a constant risk of interception and collision with planet Earth. With that in mind, a more urgent matter of detecting and investigating strategies to avoid these potential catastrophic events also presents itself as a great motivator for the study of these bodies. Consequently, a mission in which a spacecraft is sent to orbit an asteroid to study its shape and composition is of great interest to the scientific community. However, the modeling of the dynamics of an orbit around one of these bodies presents some challenges. Their small masses, irregular shapes and mass distribution result in gravitational fields with different conditions for any keplerian orbits to be achieved. It is possible to search for conditions in which quasi-periodic orbits may be achieved, but the extent of a possible mission in this scenario is also limited by the natural settings of the problem. With

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that in mind, this study proposes the use of a solar sail embarked in the spacecraft as a form of thrust to stabilize and increase the time in which the spacecraft maintains itself orbiting the asteroid. This is possible by implementing a strategy to orient the sails pointing direction as a function of the spacecrafts relative position regarding the asteroid. As a consequence of using a solar sail with the correct attitude strategy, it is possible to extend the duration of an asteroid exploration mission. This means a more cost efficient mission, which is capable of performing a more detailed study of its final target.