ORBITAL TRAJECTORIES IN THE VICINITY OF SATURN'S MOONS PROMETHEUS, EPIMETHEUS, JANUS AND PANDORA.

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Saturn has a large number of satellites, about 62, the exact number is still uncertain and numerous objects orbit the planet. Four of them draw attention due to irregularity in their shape and mass distribution and, consequently, their non-central gravitational field. Prometheus, Epimetheus, Janus and Pandora have a radius of 43.1 km, 58.1 km, 89.5 km and 40.7 km, respectively, and orbit Saturn with the characteristics shown in Table 1.

	Prometheus	Epimetheus	Janus	Pandora
a	139380km	151410km	151460km	141720km
e	0,0022	0,0098	0,0068	0,0042
i	0,008º	0,351º	0,163º	0,050º

This work present a study which considers the magnitude of the non-central gravitational potential of the moons, as well as the magnitude of other perturbative forces capable of altering the orbit of a spacecraft immersed in the region of influence of these moons. The gravitational attractions of the Sun, Saturn, and also the perturbative effects due to the other Saturn's moons are also considered.

Given the significant mass difference between Saturn and moons selected for the study, and the fact that its orbits is very close to the planet, maintaining a stable orbit in the vicinity of these moons becomes a difficult but necessary task for situations in which the goal is to overflight, approach or landing [1].

Thus, a strategy is proposed to maintain the spacecraft in the vicinity of the moons with the use of continuous thrust and closed loop control system, in a way that is possible to describe trajectories near to the surface of the moons.

The non-central gravitational potential of the moons is defined through the use of a polyhedral model, provided by NASA [2], associated to a model which uses mass concentrations allocated in the baricenter of the polyhedrons that make up the shape of the moons [3]. All the simulations of the trajectories, as well as the accomplishment of the maneuvers, were made using the Spacecraft Trajectory Simulator (STRS, [4;5]).

The analysis of the perturbative forces that cause deviations in the spacecraft's trajectory and the estimation of the total velocity increment necessary to correct the trajectory, are essential in the analysis of a mission that aims to orbit in the vicinity of the moons of Saturn, approach or landing on the surface of them.

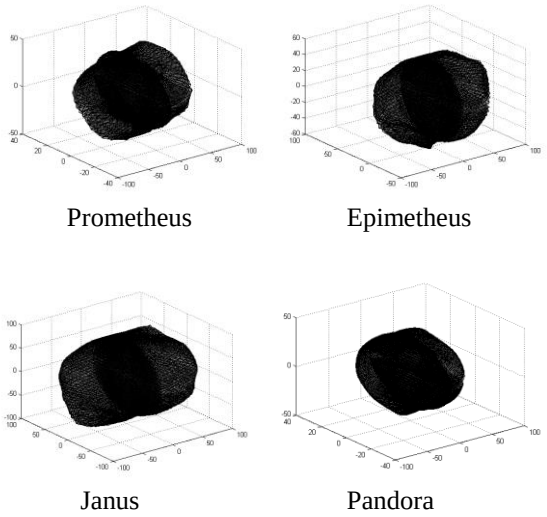

Figure 1. Shape of the moons (km).

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