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Trajectories in the neighborhood of Phobos and Deimos aiming coverage and approaching

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Due to some interesting physical and orbital characteristics of Phobos and Deimos, satellites of Mars, research involving these moons has grown. These moons have a highly irregular shape and their orbits are close to Mars. In addition, Phobos and Deimos have a high potential to provide important information about the evolution of the Mars system as well as to contribute to a future manned mission to Mars. There have been some attempts to visit Phobos, none of them successfully and, to this day, no mission has been sent to Deimos. This work presents a detailed study of the main perturbations capable of altering the orbit of a spacecraft that orbits Mars, Phobos and Deimos, in order to understand the dynamics of spacecraft movement in the proximity of such bodies and seek cases where it is possible to find stable or near stable orbits around Phobos and Deimos for the maximum possible time. Strategic trajectories are presented that allow the spacecraft to visit both moons on a regular cadence, to approach or to cover the moons. All trajectory simulations are performed using the Spacecraft Trajectory Simulator (STRS). The considered perturbations on the orbital motion of the spacecraft are: the gravitational potential of Mars, expanded in spherical harmonics up to degree and order 80, the gravitational attraction of the Sun, the gravitational potential of Phobos and Deimos and the solar radiation pressure. For the perturbations due to Phobos and Deimos is used a polyhedral model to define the shape and mass distribution of these bodies.

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