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Double lunar swing-by from periodic orbits in the restricted four-body problem

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One of the most used strategies to reach deep space is the swing-by maneuver, a type of maneuver that is already well known and used in many important missions, such as the Voyager missions. This work explores the planning of interplanetary missions using space trajectories in which two lunar swing-bys are performed, under the dynamics of the Restricted Four-Body Sun-Earth-Moon-spacecraft Problem. A spacecraft is initially inserted in a trajectory derived from a first lunar swing-by on a retrograde periodic orbit around the Lagrangian point L1 and the second lunar swing-by is performed after a maneuver on the apogee of this trajectory. The energy gain, the maximum distances achieved with this maneuver, and its costs in terms of velocity increments are presented. The results show that the double lunar swing-by is not sufficient to provide the required energy for a spacecraft to reach the planets Mars and Venus. Still, it provides gains of up to 3.6% in the increment of velocity, compared to the patched conic approximation, to reach the same distances of aphelion or perihelion.

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Poster