

SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 2 (2B)

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OPTIMISATION OF SATELLITE CONSTELLATIONS AROUND THE MOON

Abstract

Nowadays, we return to live a period of lunar exploration. China, Japan and India heavily invest in missions to the moon, and then try to implement manned bases on this satellite. These bases must be installed in polar regions due to the apparent existence of water. Therefore, the study of the feasibility of satellite constellations for navigation, control and communication recovers importance. The Moon's gravitational potential and resonant movements due to the proximity to Earth as the Kozai-Lidov resonance, must be considered in addition to other perturbations of smaller magnitude. The usual satellite constellations provide, as a basic feature, continuous and global coverage of the Earth. With this goal, they are designed for the smallest number of objects possible to perform a specific task and this amount is directly related to the altitude of the orbits and visual abilities of the members of the constellation. However, the problem is different when the area to be covered is reduced to a given zone. The required number of space objects can be reduced. Furthermore, depending on the mission requirements it may be not necessary to provide continuous coverage. Taking into account the possibility of setting up a constellation that covers a specific region of the Moon on a non-continuous base, in this study we seek a criterion of optimisation related to the time between visits. The propagation of the orbits of objects in the constellation in conjunction with the coverage constraints, provide information on the periods of time in which points of the surface are covered by a satellite, and time intervals in which they are not. So we minimize the time between visits considering several sets of possible constellations and using genetic algorithms.