

Multi-rover navigation on the lunar surface

B. Dabrowski (1), M. Banaszekiewicz (1)

(1) Space Research Centre PAS, Bartycka 18a, 00-716 Warsaw, Poland (cbk@cbk.waw.pl / Phone: +48-22-840-37-66)

Paper presents a method of determination accurate position of target (rover, immobile sensor, astronaut) on surface of the Moon or other celestial body devoid of navigation infrastructure (like GPS), by using a group of self-calibrating rovers, which serves as mobile reference points. The rovers are equipped with low-precision clocks synchronized by external broadcasting signal, to measure the moments of receiving radio signals sent by localized target. On base of registered times, distances between transmitter and receivers installed on beacons are calculated. Next, the relative position of transmitter is converted to absolute coordinate system, on the basis independent navigation carried out by radio beacons. Each rover establishes and corrects its own absolute position and orientation by use of odometry navigation and measurements of relative distances and angles to other mobile reference points. Accuracy of navigation has been improved by the use of calibration algorithm based on extended Kalman filter, which uses internal encoder readings as inputs and relative measurements of distances and orientations between beacons as feedback information. The key idea in obtaining reliable values of absolute position and orientation of beacons is to first calibrate one of the rovers, using the remaining ones as reference points and then allow the whole group to move together and calibrate all the rovers in-motion.