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Author: Mr. William Crowe
UNSW Australia, Australia, w.crowe@unsw.edu.au

Mr. John Page
UNSW Australia, Australia, j.page@unsw.edu.au
Dr. John Olsen
UNSW Australia, Australia, j.olsen@unsw.edu.au
Dr. Nathan Kinkaid
UNSW Australia, Australia, n.kinkaid@unsw.edu.au

MAPPING ASTEROID SURFACES WITH ROVER SWARMS

Abstract

Future missions to asteroids are likely to incorporate surface rovers that can enhance the data gathered by rendezvous spacecraft. Swarms of rovers could be used to cover ground faster and also provide a robust platform over unknown terrain. A rover which has received special attention recently is the hedgehog, developed by JPL and Stanford University, that moves using internal actuation and is capable of moving well over a range of asteroid surfaces. This paper describes efforts to map hedgehog rover measurements and attitudes about asteroid surfaces in order to produce a useful data set from the distributed swarm. It is assumed that the rovers will be accompanied by a single orbiting spacecraft, which will interact with the swarm to complete the position and attitude solution. The proposed work of the research is to simulate with several swarm control strategies and formations to find which strategy produces a more accurate map. The simulations are first tested as a simple two dimensional map and then tested in three dimensions over the asteroid Eros. Early results show that the most accurate mapping is produced when each rover can be seen by at least one other and all rovers are in sight of the spacecraft. An early recommendation is to synchronise the movement of the swarm with the movement of the spacecraft over the asteroid surface, leading to set orbits where deploying the swarm is of greater benefit.