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HUMAN EXPLORATION OF THE SOLAR SYSTEM SYMPOSIUM (A5)
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ASSISTED TELE-OPERATION AND AUTONOMOUS OPERATION FOR PLANETARY ROVERS USING RE-ACTIVE VETOR EQUILIBRIUM (RAVE) NAVIGATION

Abstract

Future manned and un-manned planetary exploration missions will increasingly involve the usage of and interaction with robotic vehicles. Operations of robotic vehicles for planetary exploration tend to include durations of complete autonomy and durations of complete control by the human operator from afar, called teleoperations. Planetary exploration missions could benefit from combining the advantages of human operators, who can make quicker and wiser decisions during operation, and autonomy from the vehicle which can process multiple signals that continuously come from the vehicle sensors. The Re-Active Vetor Equilibrium (RAVE) solution presented here is a hybrid combination of the potential field based reactive controller and a human operator. This hybrid combines both the global operator direction with local data taken from vehicle sensors. The combination of global and local information improves the local vehicle motion and reduces the chance of collision with obstacles unseen by the operator. Novel within the RAVE algorithm is the representation of the vehicle as a collection of point charges as opposed to a single point charge, the use of resultant forces and torques as direct control inputs onto the vehicle body, and the use of a velocity dependent risk force. The RAVE algorithm has also been shown to be compatible with a SLAM/waypoint selection process global planner. The RAVE algorithm is persented with a discussion of the forcing functions, and of limitations. Simulated pathing shows improvement over existing potential field approaches and these results are presented. Demonstration videos of vehicle implementation are presented with discussion.