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DESIGN AND SIMULATION OF A BALANCE CONTROLLER FOR A LUNAR ROVER DESIGNED FOR THE GOOGLE LUNAR X-PRIZE COMPETITION

Abstract

The Google Lunar X-Prize is a space competition sponsored by Google intended to spur the development of privately funded unmanned lunar missions. In order for a team to win the competition's grand prize, it must deliver a robot rover to the lunar surface, have it travel a distance of at least five hundred meters, and return high definition video and imagery to Earth. Bonus prize money may be obtained if the rover can operate at night, travel a distance greater than five kilometers, detect water, or return images of an Apollo site or another site of lunar site of manmade hardware. The Rocket City Space Pioneers is participating in this competition, and consists of a partnership between the University of Alabama in Huntsville, Teledyne Brown Engineering, Andrews Space, Spaceflight Services, Draper Laboratory, Dynetics, and the Von Braun Center for Science Innovation. The first prototype of the rover has been designed and built by a team at UAH. The rover utilizes telescoping legs to manipulate the rover's body roll and pitch in order to maintain an optimum balance and traction on rough lunar surface. This paper presents the derivations and simulations of the control law that automatically decides how to adjust the rover's legs for optimum balance and traction in response to the terrain's topology. The simulations allow the assessment of the effectiveness of using a leg-wheeled design to control the motion and stability of the rover. Experimental verification of the controller is planned using the rover prototype.