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BIOLOGICALLY INSPIRED TRANSFORMING ROVING-ROLLING EXPLORER (TRREX) ROVER
FOR LUNAR EXPLORATION

Abstract

Over the years, we have sent numerous rovers to the Moon and Mars, but all of them have been limited in their mobility. For example, we have not yet been able to venture into craters or down ravines. With game changing developments over the past decade in robotic technologies, we are at a juncture in planetary exploration technology where we can transition from the conventional rocker bogie suspension rover design and start employing more unconventional designs. We have been constructing and evaluating one such design called the Transforming Roving-Rolling Explorer (TRREx) Rover. Biologically inspired by the way the armadillo curls up into a ball when threatened, and the golden wheel spider uses the dynamic advantages of a sphere to roll down hills when escaping danger, the TRREx rover can traverse like a conventional 6-wheeled rover over conventional terrain, but can transform itself into a sphere, when necessary, to travel down steep inclines, or navigate rough terrain. Our paper will present the overall design of the rover and the hardware development and prototype testing we have conducted. We will also present computer simulations demonstrating how our rover performs over simulated lunar terrain, to illustrate the capabilities of the rover. We believe this work represents an important step in developing a rover capable of traversing a variety of terrains that are impassible by NASA's current fleet of rover designs, and thus has the potential to revolutionize the way NASA conducts lunar exploration.