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ROBUST UNMANNED PLANETARY SURFACE EXPLORATION THROUGH SELF-DRIVEN SPHERICAL ROVERS

Abstract

The challenge of planetary surface exploration requires very robust rovers that can move through rough terrain in extreme environments. Today, all lunar and planetary rovers have been wheel-driven where many design concepts have been based on legged systems, all of which face serious difficulties for mobility. We propose a radically different concept to partly overcome this issue: a self-driven spherical rover that can traverse rough terrain and slopes.

The main advantages of spherical rovers are its simplicity and the fact that all moving parts can be isolated inside the spherical shell compared to wheel-driven or legged rovers. This approach makes them much more resistant to the aggressive effects of regolith, and also improves thermal control issues. Electronic parts and batteries are in the shadow, easily cooled and isolated from the high temperatures over the regolith surface. This simplicity conveys the possibility of constructing the rover at a much reduced cost as compared with classical planetary rovers. The simplicity makes them particularly resistant to malfunctions but, on the negative side, the payload capability, its access and orientation with regard to the ground is reduced. Energy gathering became an issue to overcome for large mission periods.

We want to test this concept in the Moon. This spherical rover was selected as one of three rovers that will be sent by the Team FREDNET that is participating in the Google Lunar X-Prize. Students were involved in the spherical rover concept development and validation, resulting in a very motivating scholar activity.