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Beneficial Aspects of Mobility Simulation for Planetary Rovers

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Decisions like using a planetary rover on unexplored space terrain need a lot of preparation in advance. The mission for such a rover is very often defined as to ascertain the unknown environment. Very often equipped with highly complex sensors and measuring devices, the rover has to work reliable and provide autonomous high mobility behavior. For that reason, it is very important to get an realistic estimation of expectable mobility performance prior to the realization of the whole rover concept. Since mobility performances depends very strongly on the vehicle design as well as on the running gear-soil-interaction, mobility simulations during the development process of a rover could help to avoid failure. Usually, before starting a planetary rover mission, reconnaissance missions take place with the goal, to collect first data of the atmosphere and the soil.

At this first approach, it is very often not possible to obtain soil data as detailed as desired. Therefore it is necessary to have tools which can use this first data approach to provide reliable forecasts anyhow.

For the mobility side, soil data can be obtained with some simple trials – oftentimes on site during the first reconnaissance mission – to get a first set of basic parameters. These tests are simple pressure-sinkage- and shear stress-shear displacement-tests. Based on this more or less easy to obtain soil characterization, it becomes possible by using the computer program WINMAKU to simulate mobility performance of a planetary rover.

With information about the soil, the gravity and the atmosphere, key parameters for rover movement like drawbar pull, driving resistance, speed and acceleration potential, power consumption, gradeability, possible driving range and many more could be estimated. Furthermore, every change in the rover design and configuration could be

analyzed in view of its influence on mobility performance.

Precisely because mobility performance is not the very first task – but nevertheless a key issue – for a planetary rover, the propulsion system and the running gear-soil-interaction should be investigated as carefully as possible to provide a reliable base for a successful space mission. The simulation program WINMAKU can help to tailor a rover configuration to the desired need and to run parameter analysis to estimate the influence of certain measures on mobility performance.

In this respect, the presented paper shows exemplary simulation results to give an overview of possibilities and to explain the basic approach of mobility simulation for planetary rovers.