Alberto Gallina et al., J Aeronaut Aerospace Eng 2016, 5:2(Suppl)
http://dx.doi.org/10.4172/2168-9792.C1.013

Analysis of (soft) soil parameter uncertainty in planetary rover mobility simulations

Alberto Gallina, Rainer Krenn and **Tadeusz Uhl**
AGH University of Science and Technology, Poland

A crucial aspect in planetary exploration is connected with the mobility of planetary rovers on sandy terrain largely present on the Moon and Mars surface. Travelling on soft terrain rovers may experience very high sinkage, which significantly reduces vehicle mobility. In order to reduce the risk of burying a rover's wheel into a sandy terrain, extensive experimental and numerical analyses have been conducted. Several simulation frameworks for predicting the rover behavior on soft terrain through dedicated computer models have also been developed by research institutes. In this context, semi-empirical formulations of wheel-soil contact models based on the so called Bekker-theory have been advocated. They ensure a good compromise between model accuracy and simulation time. However, Bekker-based contact models need the estimate of a set of terrain parameters by dedicated laboratory tests. But large uncertainty always affects the soil parameters identification step. It mainly appears as the impossibility to exactly reproduce under laboratory conditions of the soil where the rover travels on. This lack of knowledge may strongly limit the rover behavior prediction capabilities of computer models. In this work different numerical frameworks are presented for uncertainty treatment in wheel-soil contact models based on Bekker's theory. Polynomial chaos, fuzzy method and Bayesian approach are employed to propagate soil parameter uncertainty through the model for assessing possible predicted rover paths. Results from the analysis is presented and extensively commented.

Biography

Alberto Gallina has completed his PhD from AGH University of Science and Technology in Krakow where he is currently Assistant Professor and teaching subjects like Mechanics and Uncertainty Analysis. He took part in several research projects on the same topics. He had been a 15-month guest scientist in the DLR – Institute of Robotics and Mechatronics where he joined the ExoMars project. He is author of 10 papers in reputed journals.

alberto.gallina@agh.edu.pl

Notes: