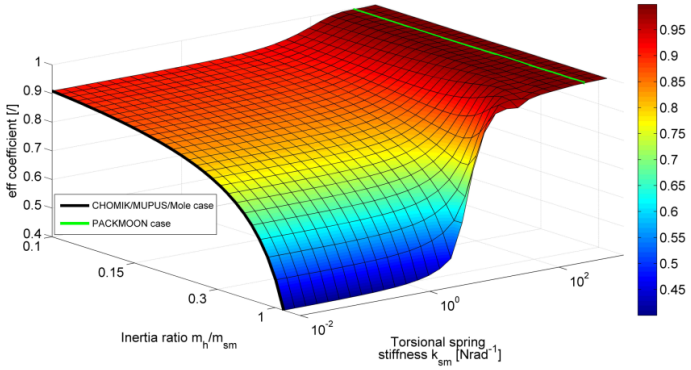
Sample return space missions are one of the possible options to extend our knowledge about extra-terrestrial materials, processes occurring on surface and subsurface level, as well as interactions between regolith and technology. Collection of surface or subsurface material from such bodies is a key technical process that needs to be performed to achieve the goals of such missions. Although in terrestrial environment the sampling process is relatively easy, smart solutions are needed for zero gravity, unknown and remotely accessible space environment.



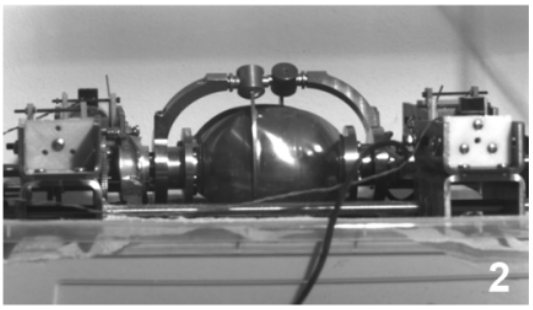
The issue of IEEE/ASME Transactions on Mechatronics (Volume: 21, Issue: 5 , Oct. 2016) features paper:

The new concept of sampling device driven by rotary hammering actions

written by Karol Seweryn, Space Research Centre, PAS.

In this paper the concept of a new type of sampling device, called PACKMOON, dedicated for low gravity bodies space environment, is presented (figure on bottom left). The principle of operation of the PACKMOON device is based on two key elements: insertion of the spherical jaws (casing) into regolith by rotary hammering actions and minimization of interaction with the lander by taking advantage of doubling mechanical subsystems, which operate in the same angular direction but in opposite sense. As a result a significant improvement of effectiveness in comparison to previous CBK penetrometers were achieved (figure on left).

Numerical simulations validated by experimental results allow (figure on bottom right) to optimize the device. As a result, the PACKMOON device is a reliable mechatronic system that effectively uses power to sample relatively hard material (up to 5-7 MPa) with minimum interaction with the lander. In addition, both thermal and mechanical interaction with the sample is relatively small, and in that sense the sample is more valuable for further scientific investigations. This issue is a key driver for planned sample return missions such as ESA Phootprint mission to Phobos.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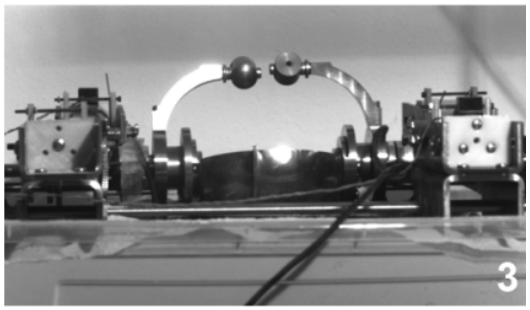
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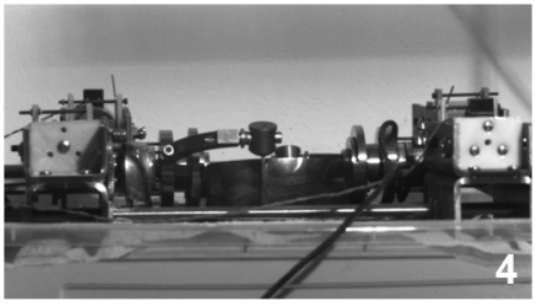
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