

Pressure Measurement during Penetration Experiments

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Abstract

Penetration experiments are common tools for the investigation of physical surface properties. Additionally penetration experiments will find several applications in exploration missions in the near future.

A penetration test stand has been flown for the investigation of penetration force reduction under reduced gravity in the 2nd Joint European Partial-G Parabolic Flight Campaign (JEPPF-2) of ESA, CNES and DLR [1].

The main contribution to the bearing resistance of a soil is combined of shaft and base resistance. During the penetration the grains of the granular material will be squeezed into the surrounding material. The penetration will cause a change in the pressure distribution inside the surrounding soil [2],[3]. An experimental setup has been designed and built for understanding and measurement of this induced pressure distribution.

In the last year the parabolic flight test stand has been further developed for the measurement of pressure during the penetration process. The main part of the experiments stayed the same with a steel rod penetration into a sample cell measuring the penetration force and recording it in relation to the depth. The sample cell is equipped with a supporting sieving mechanism for

sample preparation. The pressure sensors are mounted at the sample cell.

During the last test campaigns the principle of measurement has been investigated and first measurements have been performed.

In the presentation the measurement principle will be shown and its implementation into the parabolic flight setup. Pressure measurement results on ground tests of different penetrator and tip configurations will be presented.

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[3] M. Grott, J. Knollenberg, C. Krause, Apollo lunar heat flow experiment revisited: A critical reassessment of the in-situ thermal conductivity determination, Journal of Geophysical Research, 2010

