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Comparing traditional geomechanical and remote sensing techniques for rock mass characterization

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Analysis of the stability conditions of rock masses starts from detailed geo-structural surveys based on a systematic and quantitative description of the systems of discontinuities. Traditionally, these surveys are performed by implementing the classical geomechanical systems, available in the scientific literature since several decades, through the use of simple tools such as the geological compass to measure dip and dip direction directly on the discontinuity systems, and to fully describe their more significant physical characteristics (length, spacing, roughness, persistence, aperture, filling, termination, etc.). In several cases, this can be difficult because the discontinuities, or even the rock face, cannot be easily accessible. To have a complete survey, very often the involvement of geologists climbers is required, but in many situations this work is not easy to carry out, and in any case it does not cover the whole rock front.

Today, to solve these problems, traditional geomechanical surveying is implemented by innovative remote techniques using, individually or in combination, instruments such as terrestrial laser scanners and unmanned aerial vehicles to build a point cloud.

This latter permits to extract very accurate data on discontinuities for stability analyses, based on areal and non-point observations. In addition, the point cloud allows to map sub-vertical walls in their entirety in much shorter times than traditional surveying.

At this regard, two rock slopes were detected in the Sorrento Peninsula (Campania, southern Italy) with techniques that include traditional mapping, dictated by the guidelines of the International Society for Rock Mechanics, and the remote survey, through laser scanning and drone photogrammetry. The data obtained were processed automatically and manually through the Dips, CloudCompare and Discontinuity Set Extractor softwares.

In the present contribution we highlight the limits and advantages of the main data collection and the processing techniques, and provide an evaluation of the software packages currently available for the analysis and evaluation of discontinuities, in order to obtain a better characterization of the rock mass.