

Structural rock mass parameters recorded by a computer vision system

A. Gaich, A. Fasching, R. Fuchs
3G Gruppe Geotechnik Graz, ZT GmbH, Austria

W. Schubert

Institute for Rock Mechanics and Tunnelling, Graz University of Technology, Austria

Abstract:

Field mapping in surface and subsurface rock engineering projects try, among others, to acquire visible geometric features like discontinuities, in order to get a proper model description of the rock mass. Usually, several parameters of discontinuities are required to be measured, such as orientations, trace lengths, and spacing. These parameters are commonly determined using a tape measure and a compass-clinometer device causing the data to be incorrect and inconsistent. Due to the need for physical contact to get the measurement, field mappers have to work in unsupported, hazardous regions regularly which might entail, that features are sometimes just estimated or remain even assigned.

Within this contribution an improved data acquisition method is presented. A computer vision system is used to record an exposed rock mass. Computer vision can be seen as connecting camera(s) to a computer and processing the acquired image(s) on it in order to get some description of the recorded objects.

In the actual case a portable imaging system consisting of a high-resolution panoramic camera is used, capable to take images with a 360° field of view. The resulting digital images resolve fine object details within the large field of view. This principle is benefiting e.g. when applying the system to highwall mapping with long drawn-out rock faces or in surface and subsurface environments, where possibly existing reference points can be imaged, regardless of their location around the camera.

At least two different images of the rock face are taken and then processed with proprietary software. It manages the large data amount, handles the special geometry of the images and allows several kinds of image analyses. Among these, a stereoscopic inspection tool is provided. Stereoscopic vision brings a tremendous advance for the interactive mapping and assessment process, as all parts of the rock face can be inspected with the same accurateness and ease. Quick changes in the observation scale are possible and measurement marks can be placed, resulting in a kind of a "virtual" compass-clinometer device.

The evaluation software allows for the interactive identification and annotation of rock mass structures and manages the resulting data, that may be input for additional processing, like statistics or modelling software, which is shown exemplarily in the contribution.

The data acquisition process takes place without physical contact, i.e. the according measurements are taken indirectly. This means no pressure of time or danger for an arbitrary number of samples. The resulting enhanced model presents a better rock mass description, which maximizes support efficiency and improves planning, both reducing costs.

The described data acquisition system is a step beyond the state of the art. The improved data quality together with the increased safety for the acquisition process may support the definition of a new standard. The recorded data may also support training and future project planning.