JointMetriX3D - Measurement of structural rock mass parameters using a computer vision system

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Abstract:
An innovative approach to determine geometric entities of a rock mass is presented. Using a computer vision system, it becomes possible to get a comprehensive documentation and detailed measurements of geotechnic rock mass parameters, such as trace lengths, spacing, lithological areas, discontinuity orientations, and roughness parameters. Presently, these magnitudes are determined using a compass-clinometre device and a measuring tape, which requires a physical contact to get the measurement. This might take great expenses in time and efforts, and eventually requires work in hazardous areas. For this reasons those parameters sometimes even remain assigned. However, present practice does not deliver data suitable for further analytic processing and analysis.

Within this contribution an improvement based on a computer vision is given. Computer vision can be seen as connecting one or more cameras to a computer and processing the acquired images on it, in order to get some description or measurements of the recorded objects. A special imaging device based on a digital panoramic camera is used. It can take images with a 360° field of view at resolving fine object details within this large field of view. At least two different images of a rock face are taken and then processed with proprietary software components, that manage the large data amount, handle the special geometry of the images and allow several kinds of image analyses, such as spatial inspection and geometric measurements.

Using a stereoscopic representation of the rock mass on the computer, the individual analyses are tremendously advanced. Stereoscopic vision supports the interactive mapping and assessment process, as all parts of the rock face can be inspected with the same accurateness and ease, independently if they are in regions with difficult access. Quick changes in the observation scale are possible and measurement marks can be placed, resulting in a kind of a virtual compass-clinometre device and a virtual measuring tape.

As the data acquisition and analysis processes take place without physical contact, the measurements are taken indirectly. Measurements are made at an arbitrary number, without danger and pressure of time. The resulting spatial model represents a better rock mass description, which maximises support efficiency and improves excavation or outcrop planning, both reducing costs and increasing safety.