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Kinematical analysis of rock blocks supported by 3D imaging

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ABSTRACT: Remote sensing technologies are increasingly applied in the geological and geotechnical engineering. Especially the 3D imaging technology provides important information about the geometry of rock faces and the structure of the rock mass. 3D images provide a dense grid of measurement points combined with a digital image aligned with the surface topography. This contribution presents an approach for kinematical analyses of rock blocks based on discontinuity data gained from 3D images.

In a review on block kinematics translational and rotational block displacements, the kinematical mode analysis, as well as translational and rotational failure modes are discussed. It is highlighted that a kinematical analysis comprising translational and rotational failure modes requires the determination of the block geometry. The data required for the determination of the block geometry is gained from 3D images. Two 3D imaging systems based on photogrammetry and computer vision are described. The application of 3D imaging technologies for kinematical analysis is outlined in two illustrative examples. The JointMetrix3D system provides information of discontinuities in a rock slope for a study of block kinematics. The second example shows 3D imaging in an underground mine using the ShapeMetriX3D system. Discontinuity data from face images are sampled to a trace map which serves for the identification of kinematically free blocks.