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Capabilities of continuous and discontinuous modelling of the rock slopes – a landslide in the Carnian Alps (Italy) using as an example

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It is commonly known that due to fractures, joints, faults, etc., rock mass is discontinuous geologic medium. Nevertheless, in the solutions of deformation and stability problems of the slopes, composed of the rock mass, principles of continuous medium mechanics are used. Mountain slopes are most often built of discontinuous rock mass and their behaviour depends much less on the rock matrix quality but to a large extent on the properties of discontinuities, such as joints and their systems, which split the intact rock into the blocks. Very important is the orientation of joint sets, and the failure processes develop along them, whereas rock matrix remains intact.
In many cases, application “continuum mechanics” methods in the solution of the real rock mechanics problem gives sufficiently accurate results. However, there is a class of problems, in which above methods could give erroneous answers. The overall behaviour of the medium in such problems is mainly governed by the presence of the discontinuities and modelling of the rock mass as a continuum could be doubtful.
The objective of the paper is to compare the results of the numerical simulation of the slope deformation and stability, by applying continuous and discontinuous model. The landslide located on the right flank of Tagliamento river valley serves as an example. It is a quaternary mass movement, laying in regions of structural weakness, caused by the Alpine orogeny. Its most upper part is composed of steeply inclined, huge zone of hard limestone, which is regularly jointed and thus divided into the blocks. The relatively weak and soft rocks, such as clay, gypsum and moraine deposits constitute lower part of the slope.

Two numerical codes are used in this simulation, namely FLAC and UDEC. The first one is especially devoted to the continuous medium problems, whereas second to the discontinuous, blocky structures. Both are based on the finite differences method and allow to determine the stress and strain distribution in the model of the geologic medium, exhibiting complex behaviour.

The solution results clearly show the possibilities of each of the methods. The continuous approach allows first of all to simulate in a proper way the sliding behaviour of the layers. Application of the discontinuous model makes possible to simulate in easy way both rockfall and toppling failure of the limestone zone as well as the slide in the underlying, more weak rocks.

It has to be pointed out that there are not any results from terrain measurements. Therefore, verification of the results appropriateness is impossible. However, the task of the paper is to present and discuss the possibilities, advantages and disadvantages of above two approaches and the objective is accomplished.