

The Usability of Rock-Like Materials for Numerical Studies on Rocks

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The approaches of synthetic rock material and mass are widely used by many researchers for understanding the failure behavior of different rocks. In order to model the failure behavior of rock material, researchers take advantage of different techniques and software. But, the majority of all these instruments are based on distinct element method (DEM). For modeling the failure behavior of rocks, and so to create a fundamental synthetic rock material model, it is required to perform related laboratory experiments for providing strength parameters. In modelling studies, model calibration processes are performed by using parameters of intact rocks such as porosity, grain size, modulus of elasticity and Poisson ratio. In some cases, it can be difficult or even impossible to acquire representative rock samples for laboratory experiments from heavily jointed rock masses and vuggy rocks. Considering this limitation, in this study, it was aimed to investigate the applicability of rock-like material (e.g. concrete) to understand and model the failure behavior of rock materials having complex inherent structures. For this purpose, concrete samples having a mixture of %65 cement dust and %35 water were utilized. Accordingly, intact concrete samples representing rocks were prepared in laboratory conditions and their physical properties such as porosity, pore size and density etc. were determined. In addition, to acquire the mechanical parameters of concrete samples, uniaxial compressive strength (UCS) tests were also performed by simultaneously measuring strain during testing. The measured physical and mechanical properties of these extracted concrete samples were used to create synthetic material and then uniaxial compressive tests were modeled and performed by using two dimensional discontinuum program known as Particle Flow Code (PFC2D). After modeling studies in PFC2D, approximately similar failure mechanism and testing results were achieved from both experimental and artificial simulations. The results obtained from these laboratory tests and modelling studies were compared with the other researcher's studies in respect to failure mechanism of different type of rocks. It can be concluded that there is similar failure mechanism between concrete and rock materials. Therefore, the results obtained from concrete samples that would be prepared at different porosity and pore sizes can be used in future studies in selection micro-mechanical and physical properties to constitute synthetic rock materials for understanding failure mechanism of rocks having complex inherent structures such as vuggy rocks or heavily jointed rock masses.