Evaluation of crack opening in the heterogeneous materials by X-ray CT

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ABSTRACT

An improved crack projection method for the analysis of open crack was introduced by applying image subtraction technique. In order to evaluate crack opening in the heterogeneous materials such as rocks, X-ray CT image subtraction method was introduced in the data processing together with necessary noise reduction method, using the 3-dimensional data given by X-ray CT. This is a promising method to analyze open cracks in the heterogeneous materials from the difference of X-ray CT images. The characteristic point of the method is that the reduction and the elimination of fatal noise related to X-ray CT images are possible and that the accurate image processing is expected. The fundamental formulae of noise reduction technique were firstly described and applicability for the rock sample was discussed. Then, formulae for X-ray CT image subtraction method were introduced as well as the necessary data processing for the crack opening measurement. In this study, artificial cracks were simulated by a couple of semilunar shaped rock samples. In order to verify the applicability of the method to the heterogeneous materials, the rock samples were made of granite. The subtraction method was applied to the rock samples and the accuracy of the method was discussed. It was found that the influence of noises was clearly eliminated and that the crack opening distribution was accurately evaluated. This technique was also applied to the orthorhombic rock sample and it was also proved that crack opening could be evaluated by the same procedure in the case that tomography and data processing were conducted in the same condition.

KEY WORDS: Crack opening, Image subtraction, rock, heterogeneous materials, X-ray CT