Applicability of the box-counting method to investigate the statistical homogeneity of fractured rock masses

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The realization of three dimensional fracture network system play an important role in investigating the mechanical and hydraulic characteristics of fractured rock mass. The techniques of stochastic three dimensional rock mass geometry model have been improved by contributions of former researchers but, in most of cases, the structures of rock mass geometry systems are characterized without addressing the homogeneity of geo-engineering structural domain. The fracture network system vary from one place to another with corresponding stress conditions, and fracture network model that build up with the fracture geometry data from arbitrary selected region can not represent the structural characteristics of the fractured rock mass. Also, it affect the results of mechanical and hydraulic behaviors of the fractured rock masses. Therefore, structurally homeogenous region that reflect the variabilities of fracture geometry parameters should be identified to model the three dimensional rock mass network system using the data from scanline, window and borehole survey. At present, it is difficult to delineate homogeneous domain of the rock mass deterministically, and the concept of statistically homogeneous region that captures the variability of the fracture geometry parameters should be applied. Some of the findings concerning the evaluation of statistical homogeneity for fractured rock masses which appear in the literatures have resulted from the application of contingency table analysis using number of fracture sets and their orientation distributions. To satisfy the statistical homogeneity of two regions in a rock mass, the fracture parameters in the compared regions should have similar distributions of orientation, spacing, size, shape and roughness etc.. This study suggest the applicability of using a parameter of box fractal dimension, D_B, as an index of statistical homogeneity that is able to consider the combined effect of fracture density and size distributions. The first part of the study shows the variability of D_B according to fracture density and size distributions. As an index, the capability of D_B that captures the combined effect of fracture density and size distribution is also presented systematically. The second part of this study deals with field applicability of box-counting method to investigate the statistical homogeneity of the fractured rock mass at the road cut slope in Ulsan area. The results from conventional method of contingency table analysis was compared to investigate the statistical homogeneity.

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