Rock Slope Stability Analyses by using Monte Carlo Simulation and Point Estimate Method

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1. Introduction

The most parameters of discontinuities on rock slope involve with uncertainty, so it is necessary to conduct the probability analysis and the discontinuity parameters should be considered as random variables. The purpose of this study is to develop a program based on Monte Carlo Simulation for rock slope stability and to compare the probability of failure acquired by the Monte Carlo Simulation with that acquired by Point Estimate Method. The developed program based on the visual basic language is applied for the practical example in cases of planar and wedge failure. The rock cut slope in this study area locates on Shinjeoungri - Noocheongri, Boeun kun, ChungCheong BukDo. The height and width of rock slope are 27.2m and 90m respectively, and it is composed of the feldspathic porphyry. The input data for slope stability analyses were collected in the field, and shear strength test was carried out in the laboratory. The water table level is assumed to be ranged from dry slope to saturated slope because a information for groundwater level is not provided.

2. Probabilistic Methods

The discontinuities parameters which are involved within rock slope are variable because they have the uncertainty. However, deterministic approach that its parameters are regarded as fixed value causes problems and therefore, the probabilistic analysis is needed to adopt in slope stability analysis. To solve this problem a program is developed by using Monte Carlo Simulation (M.C.S.). M.C.S. is composed of two portion (kinematic and kinetic analysis) and random number to be generated is used to repeat the procedure of program. Therefore probability of failure can be acquired by total number of repeating and the number to be less than factor of safety 1.

In addition, Point Estimate Method (P.E.M.) is applied for practical rock slope and it is approximation method for calculating probability of failure. Finally P.E.M. result can be possible to be compared with M.C.S. result. The water table is assumed to be increased as 10% of slope height.

3. Conclusions

Both probabilities of failure (M.C.S. and P.E.M.) are less than 1% in case of planar failure although it is assumed that rock slope is saturated fully. However both probabilities of failure (by

M.C.S. and by P.E.M.) are more than 1% in case of wedge failure when the level of water table is assumed to be 10% of slope height. Consequently the comparative result of two probabilistic analyses (by M.C.S. and by P.E.M.) is similar each other. Based on the comparative analysis, P.E.M. is useful for calculating the probability of failure of rock slope and this method can save time to acquire the probability of failure. In addition, M.C.S. is possible to consider many other parameters of discontinuity so that can make the realistic evaluation for rock slope stability although M.C.S. spends much time to calculate the probability of failure.

4. References

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