# Statistical Homogeneity Zone Dividing of Fractured Rock Mass in Longmen Peak, Changbai Mountain, China

Li Ming[2], Bao Shuochao[2], Li Shiyu[2], Zhang Huanbo[2]

**Abstract.** Structural homogeneity of rock mass fractures is an important problem and the basis of 3-D fracture network modeling. In this research, a new method considering trace length of fractures is suggested of statistical homogeneity zone dividing on basis of contingency table. Through generating two compared samples the frequency of the attributes of sample are calculated, and chi-square values are determined. A method of structural homogeneity zoning is constructed after judging the statistical similarity among the samples. It is proved that the result of the structural homogeneity zoning is more reasonable.

**Key words.** Fractured rock mass, structural homogeneity zone, chi-square test, contingency table.

## 1. Introduction

In the long process of geological formation,it formed a large number of joints and fissures in rock mass system, the joint fissure system can greatly determine the characteristics of fractured rock mass, which as known as discontinuity, inhomogeneity and anisotropy[1].The discontinuity is different between different geological unit , , it mainly depends on the change of the fracture parameters. In rock engineering geological problems, the t stitch length, spacing, occurrence, width and the filling material compositionr of structure flat are uneven and uncertainly distributed in the rock mass[2].In statistical sense, , the deformation and destruction have significant difference between different occurrence, trace long geological unit.Make the "similar"parameters of rock fracture into unification ??statistical ho-

mogeneity zone??which can greatly reduce work load analysis of rock mass.

## 2. Chi-square test introduction

$?^2$ test(Chi-square test) is a kind of method which to compare two or more than two samples' rate (or ratio) of the difference between the significance test. When comparing the difference of samples was caused by the inner factors rather than caused by sampling error, chi-square value is big, meanwhil P is small which is the probability ot the difference caused by sampling error sample.Then just say two sample difference is "significant" or "highly significant". Instead, a chi-square value is smaller, the greater the P value, said there was "no significant" difference of two sample.

In practice, a contingency table model can be used to calculate . There are R and C columns model in contingency table, the contingency table is shown as table 1.

Table 1. Contingency table mode

| Group Level | 1 | 2 | ... | C |
|---|---|---|---|---|
| 1 | $f_{11}(p_{11})$ | $f_{12}(p_{12})$ | ... | $f_{1c}(p_{1c})$ |
| 2 | $f_{21}(p_{21})$ | $f_{22}(p_{22})$ | ... | F $(p_{2c})$ |
| ... | ... | ... | ... | ... |
| R | $f_{R1}(p_{R1})$ | $f_{R2}(p_{R2})$ | ... | $F_{Rc}(p_{Rc})$ |
| Total | $N_1$ | $N_2$ | ... | $N_c$ |

$f_{RC}$-The R group of the C level of the sample frequency R=1,2 ... C=1,2??...
$P_{RC}$-The R group of the C level the percentage (rates) of the sample
$C_R$- The first sum of frequency of R samples of all levels
$N_C$-Each group first C level is the sum of the sample frequency
Chi-square value is calculated by the next fuormula??
$$x^2 = N(a_1 + a_2 + \cdots + a_c - 1)x^2 = N(a_1 + a_2 + \cdots + a_c - 1)$$
$$a_c = N_C(f_{1c}p_{1c} + f_{2c}p_{2c} + \cdots + f_{Rc}p_{Rc}).a_c = N_C(f_{1c}p_{1c} + f_{2c}p_{2c} + \cdots + f_{Rc}p_{Rc}).$$

## 3. Project profile

This research selected Longmen peak south of a typical high and steep slope section (that is, the railway bridge to the long corridor entrance section) as a statistical analysis object homogeneous area.

The collapse of the cliff is located in the south side along the Longmen peak which is nearly north-south trending distribution, the high and steep cliff collapse is mainly composed of Mount Paektu group trachyte and dissolving tuff breccia. Longmen peak measurement segment surface weathering is very serious, total gra-

dient is more than 60?,partly is mor than 80?.There are plentful protogensis lean columnar jontng,standard layer and secondary unloadng fractures onthe surfaceof the slope.Longmen peak has very serous colapse problems, which the discontinuity surfaces are uneven distributed on the surface. The fractrues can be divded into three groups which are: I. 6585.2columnar joints,II. 345.285.7columnar joints and 340.89 nearly horizontal joints and layer surfaces . The length of longest discontinuity surface is 11m. The gravty deformaton phenomenon is very obvious of slope, the width of discontinuity surface are larger,which is 20mm averagely, the width of widest discontinuity surface is 100mm. Discontinuity of main rolling shape are flat and undulating principally , and is mainly composed of mud filling, filling degree from 65% to 85% in general.

According to the actual situation of research area, five typical measurement sectionswere chosen as the research objects, every section is 140m. The fissure facade of two-dimensional vector quantization tracing line as shown in figures as fig1-5.
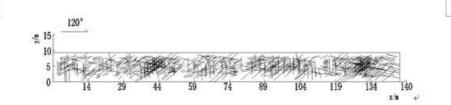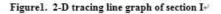
# 4. Conclusions

This research took a 170m nearly ns-trending distribution length discontinuity rock mass surface of south Longmen Peak of Changbai Mountain as object??on the basis of contingency table chi-square, considered the factor of the fracture trace length distribution, calculated chi-square value and critical chi-square value to determine whether has the statistical similarity between samples, homogeneous area statistics in fractured rock mass is divided and calculated, (28 ˜ 56 m) and (84 ˜ 112 m) in the fractured rock mass for statistical homogeneous area.It tallies with the actual, better solved the problems of the fractured rock mass statistical homogeneous division.
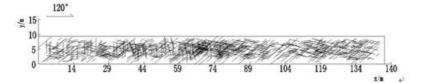
**References**

[1] J. P. CHEN, Q. WANG, S. F. XIAO: *Evaluaton of Statistical Homogeneity of Rock Mass Structural.* Journal of Geological Hazards and Environment Preservation *7* (1996), No. 1, 19–24.

[2] P. H. S. KULATILAKE, R. IEDLER, B. B. PANDA: *Box Fractal Dimension as a Measure of Statistical Homogeneity of Jonted Rock Masses.* J Sound and Vibration *7* (1996), No. 1, 19–24.

[3] J. QI, L. WANG, F. YAN, Q. XUE: *The tribological performance of DLC-based coating under the solid–liquid lubrication system with sand-dust particles.* Wear *297* (2013) 972–985.

[4] K. WONGSEEDAKAEW, J. PANICHAKORN: *Effect of Solid Particle on Rough Thermo-Elastohydrod-ynamic Lubrication with Non-Newtonian Lubricant.* Advanced Materials Research *1044* (2014), 305–309.
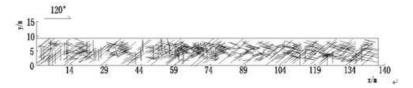
Figure1.  2-D tracing line graph of section I

Figure 2.  2-D tracing line graph of section II

Figure 3.  2-D tracing line graph of section III
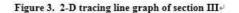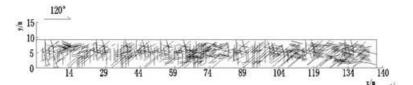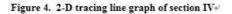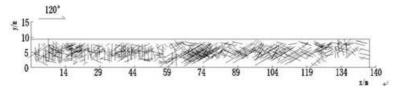
Figure 4.  2-D tracing line graph of section IV

Figure 5.  2-D tracing line graph of section V

Fig. 1.  Fig01