Modeling of Ground for Numerical Analysis of Initial Stress in Deep Part of Granite

Kinichiro Kusunose[1]; Akio Cho[1]; Katsuji Sasaki[2]; Takeshi Sasaki[3]; Ikuo Hagiwara[2]; Hitoshi Koide[4]

[1] AIST; [2] SUNCOH CONSULTANTS CO.,LTD.; [3] SUNCOH CONSULTANTS CO.,LTD; [4] Waseda

http:// www.aist.go.jp/index_j.html

It is important to grasp an initial stress state of underground deep part rock mass before hand, in examination of the design and the construction of underground space and of its long-term stability. The purpose of this study is to evaluate a relationship between initial stress by hydraulic fracturing method and stress field of a wide area quantitatively.We made two and three-dimensions of ground model for analysis using geological feature information investigated in borehole apertures to 750m deep, and calculated ground stress by a non-linear multiple yield model and by a finite element method. It is necessary for the physics fixed number of ground model division as an index to be clear in division depth and to reflect physical property of ground precisely. We paid our attention to a long-normal (LN) value by electrical logging in this study.To assume LN value division index, it is desirable that it reflects a rock mass state change of a depth direction and is in high correlation with the input fixed number on this analysis at the same time.Therefore, we examined correlation between LN value and a result of rock test and assumed that LN value reflects strength/transformation characteristic of a rock. So, we considered that LN value is appropriate for an index of division.We divided depth 750m into 20 layers from the profile of LN value. In this study, because of examination of an analysis result of two dimensional MYM and three-dimensional FEM, we assumed that ground model division was the same.In three-dimensional FEM, physical properties were set as an equivalent elastic body including the strength/transformation characteristic of intact rock and cracks and in two-dimensional MYM, we considered that physical properties were distinguished the strength/transformation characteristic of intact rock from that of crack. When rock mass is good, the difference of physical properties of rock mass by a conventional rock mass classification cannot be expressed in detail. In addition, each ground model division often includes various kinds of rock mass classification it is necessary to set an equivalent rock mass classification every ground model division.After rock mass classifications from A to D were classified into six grades from 1 to 6 we do a weighted average charge account of mayor of section of a rock mass classification every ground model division.Next we defined them as the rock mass classification index and set the physical properties value list corresponding to it. We set the physical properties every ground model division with this table. In two-dimensional MYM it is necessary to input physical properties of rock mass including a micro crack and a characteristic of a discontinuity. We adopted suggestion values of a conventional rock mass classification in tri-axial strength fixed number of ground. We adopted clear cracks that were observed with a supersonic wave-type borehole televiewer in the distribution of discontinuity.Cracks excelled in the NS direction and in the EW direction and horizontal. We assumed all cracks to be in these three directions and adopted general values in the strength/transformation characteristic. As the result of analysis initial stress by hydraulic fracturing method almost accorded with the stress by three-dimensional FEM analysis and two-dimensional MYM analysis but differences are recognized in details. Ground model division and setting of the physical properties have proved to be appropriate. Therefore we will report about the technique mainly.