Estimate of aperture of stress induced cracks during triaxial compression test by crack fabric analysis

Takato Takemura[1], Masanobu Oda[2]

[1] Graduate school of Science and Engineering, Saitama Univ., [2] Civil and Environmental Engineering, Saitama Univ.

When considering the long-term stability of rocks, changing permeability is one of the important subjects. In granitic rocks, changing permeability depended on the microcrack geometry, which served as a water pathway. The most important parameters are aperture and connectivity in the permeability coefficient in granitic rocks, in view of the geometry of a microcrack. Brace et al. and (1964) reported relationship between porosity and volumetric strain under hydraulic pressure, however, there is no quantitative study on changing the structure (a direction, density, and areture) of microcracks with brittle failure. In this study, we estimate aperture of microcracks under tri-axial compression state using stereologically based on fabric analysis.

The crack density F0 is increasing steadily with brittle fracture. This increase is related with accumulation of an inelastic volumetric strain. The inelastic volumetric strain,evl, and the increment of crack density, dF0=F0-F0(intact) , have a proportionality relation. An inelastic volumetric strain is the inclement of porosity under compression test. Therefore, this relation can describe -evl =df=ndF0. Where,n is aspect ratio of microcrack and proportionality constant when the aperture, t, of microcrack is proportional to the size, r, during triaxial compression test. In this study, we obtained n=5.28*E-4. The value of this n serves as a very important parameter, when estimating the aperture of microcrack and permeability.