بسمه تعالی

تمرینات مکانیک سنگ سری ۳ (معیارهای شکست سنگ)

۱- یک مخزن آب درون یک توده سنگی ساخته می شود آزمایشات سه محوری سنگ به صورت زیر انجام شده است.

TEST	$\sigma_3(MPa)$	$\sigma_1(MPa)$
1	1	9.2
2	5	28
3	9.5	48
4	15	74

اگر تنش کل در یک نقطه مشخص از این توده سنگ برابر زیر باشد پس از ساخت مخزن فشار آب در این نقطه حداکثر چقدر می تواند افزایش یابد تا ضریب اطمینان ۲ را تامین کند؟

$\sigma_1 = 5000\ psi$
$\sigma_3 = 1300\ psi$

2- In a plane wave front, the pressures in the plane of wave front are $\nu/(1-\nu)$ times the pressure normal to the wave front. What is the least value of Poisson's ratio (ν) such that compressive or shear failure does not occur as the wave front sweeps through the rock?

3- A set of unconfined compressive strength tests on slate specimen oriented with $\psi = 30^o$ and $\psi = 75^o$ yields strength values $q_{u,30}$ and $q_{u,75}$ respectively. Show that the direction strength of the rock can be approximated by

$$\sigma_{1,p} = \sigma_3 tan^2\left(45 + \frac{\varphi}{2}\right) + q_{u,75} - \left(q_{u,75} - q_{u,30}\right)cos2(\psi - 30)$$

Instruction

Determination the parameters S_i and φ as a function of orientation:

Expanding on a theory introduced by Jaeger (1960) McLamore (1966) proposed that both S_i *and* φ could be described as continuous functions of direction according to

$$S_i = S_1 - S_2\left[\cos2\left(\psi - \psi_{min,s}\right)\right]^n$$

$$\tan\varphi = T_1 - T_2\left[\cos 2\left(\psi - \psi_{min,\phi}\right)\right]^m$$

Where S_1, S_2, T_1, T_2, m and n are constant.

ψ is the angle between the direction of the cleavage (or schistocity bedding or symmetry plane) and the direction σ_1

$\psi_{min,s}$ and $\psi_{min,\varphi}$ are the values of ψ corresponding to minima in S_i *and* φ respectively.

4- E. Hoek and E. T. Brown (1980) introduced the empirical criterical of failure for rocks:

$$\frac{\sigma_{1,p}}{q_u} = \frac{\sigma_3}{q_u} + \left(m\frac{\sigma_3}{q_u} + s\right)^{\frac{1}{2}}$$

where m and s are constant

$$s = \left(\frac{q_u\ rock\ mass}{q_u\ rock\ substance}\right)^2$$

Compare this with below for case $m = 0$ and $s = 1$.

$$\frac{\sigma_{1,p}}{q_u} = 1 + N\left(\frac{\sigma_3}{q_u}\right)^M$$

The constants N and M will be determined by fitting a curve to the family of points

$$\left(\frac{\sigma_3}{q_u}, \frac{\sigma_{1,p}}{q_u} - 1\right)$$

5- Derive an expression for the modulus of rupture T_{MR} for a test with three point bending of a core sample (circular cross section).

6- If a bilinear failure criterion is used with a tension cutoff superimposed on the Mohr-Coulomb criterion, at what value of σ (expressed in terms of T_o, S_i, φ) are shear failure and tensile failure criteria satisfied simultaneously?