Homework Assignment 14 (Due April 10)

1) Consider the geometry of Figure 1b and two orthogonal joint sets with spacings S_1 and S_2 intersecting the vertical hole. Since the joint sets are orthogonal, their dip angles α_1 and α_2 are such that $\alpha_1+\alpha_2=\pi/2$. What is the expression for the apparent fracture frequency along the borehole in terms of the true fracture frequencies $f_1 = 1/S_1$ and $f_2 = 1/S_2$? Assume that $S_1 = S_2 = S$, and $\alpha_1 = \alpha$. Plot in a polar diagram the variation of F/f (where $f=1/S$) with α as it varies between 0 and 2π.

2) Consider the shearing of a joint with the geometry of Figure 11. The joint surface is smooth with zero cohesion and a friction angle φ. Let i be the inclination angle of the joint surface with respect to the horizontal. Show that the shear strength of the inclined joint is equal to $\tau = \sigma_n \tan(\varphi + i)$.

3) For the geometry of the plane shown in Figure 3b derive the following two equations:

$$\tan\psi_a = \tan\psi \cdot \cos\beta$$

$$\tan\psi_a = \tan\psi \cdot \sin\alpha$$

where ψ is the true dip of the plane and ψ_a is its apparent dip in a direction making a horizontal angle α with the strike direction (or β with the dip direction).

4) If the attitude of a plane is N 75° W 22° NE, what is its apparent dip in the direction N 50° E?

5) Two lines define a plane. From two apparent dips: (i) $\psi_{a1} = 10°$ in the N 72° W direction, and (ii) $\psi_{a2} = 25°$ in the N 35° E direction. Determine the strike and true dip angles of the plane.

6) A certain bed dips 40° due North. In what direction will its apparent dip be exactly half as great?

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