Midterm Examination

Oct. 30th, 2008

1. Convert strike/dip to dip direction/dip. (10)

1) N40 °E/36 °SE → 130/36

2) N52 °W/45 °SW → 218/45

3) N60 °E/50 °NW → 330/50

4) N66 °W/27 °NE → 24/27

2. Explain the process of calculating the volume of a convex block. (10)

Selecting an apex → take faces not including the apex → divide each face into triangles → make tetrahedrons with the apex and each triangle

3. Dip direction and dip of joint A, B and C are 110/50, 230/70, and 304/60, respectively. There are two blocks on the joints: one is on joint A and the other is on joint B and C (wedge failure). 1) Show that the block on joint A slides down along the dip direction and dip of joint A, and 2) obtain the sliding direction (trend and plunge) of the block on joint A and B when the blocks slide down the joints by their own weight. (20)

1) Block on A:

$\hat{s} // (\hat{n} \times \hat{R}) \times \hat{n}$

$\hat{n} = (sin50 \sin 110, \sin 50 \cos 110, \cos 50) = (0.7198, -0.2620, 0.642$

$\hat{R} = (0, 0, -1$

$(\hat{n} \times \hat{R}) = (0.262, 0.7198, 0$

$(\hat{n} \times \hat{R}) \times \hat{n} = (0.4627, -0.1684, -0.5868) \rightarrow (0.604, -0.2198, -0.76$

Plunge = Sin^{-1}(0.766) = 50, Trend = Sin^{-1}(0.604/cos50) = 110

2)

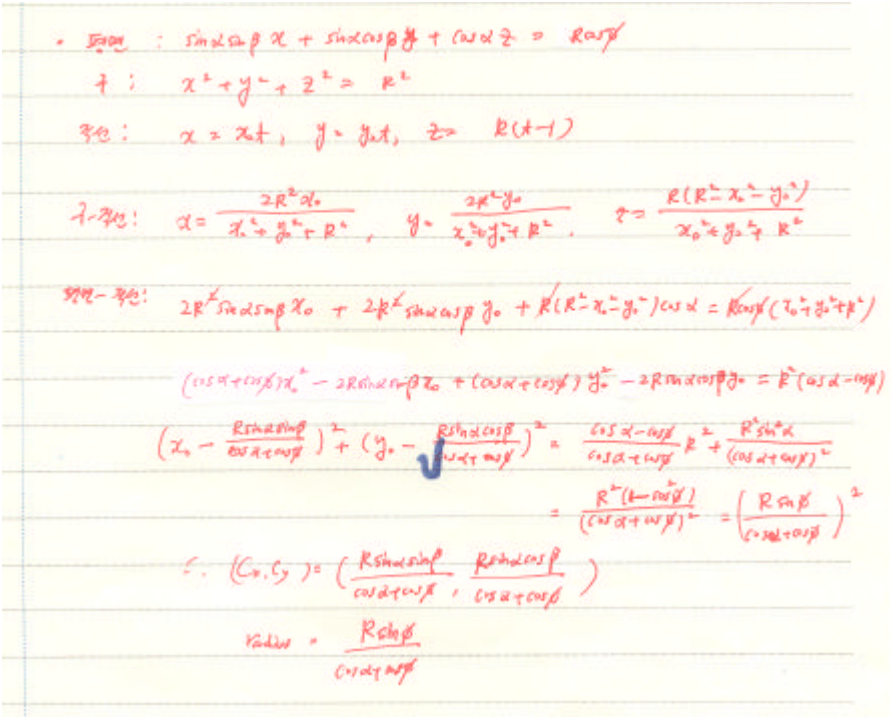
$\hat{n}_1 \times \hat{n}_2 = (sin70 sin230, sin70 \cos 230, \cos 70) \times (sin60 sin304, sin60 \cos 304, cos60)$

$= (-0.7198, -0.604, 0.342) \times (-0.718, 0.4843, 0.5) = (-0.4676, 0.1143, -0.7823)$

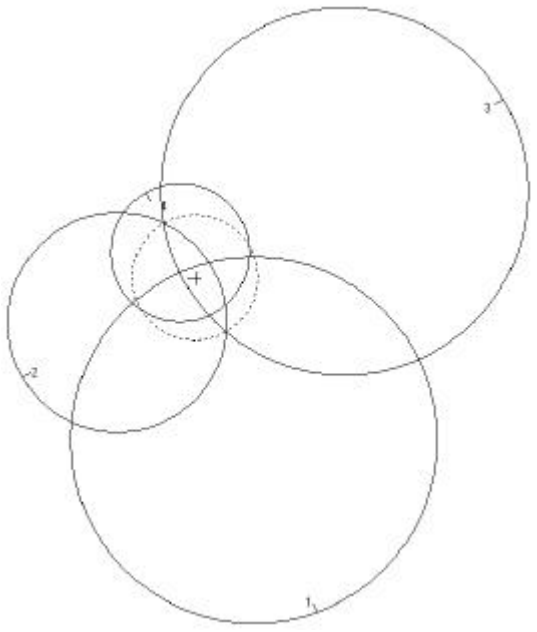
$\rightarrow (-0.5091, 0.1244, -0.8517)$

Plunge = Sin^{-1}(0.8517) = 58.4, Trend = Sin^{-1}(-0.4676/cos58.4) = 296.8

4. Prove that a small circle on a projection sphere is projected to a circle on a projection plane by stereographic projection. (20)



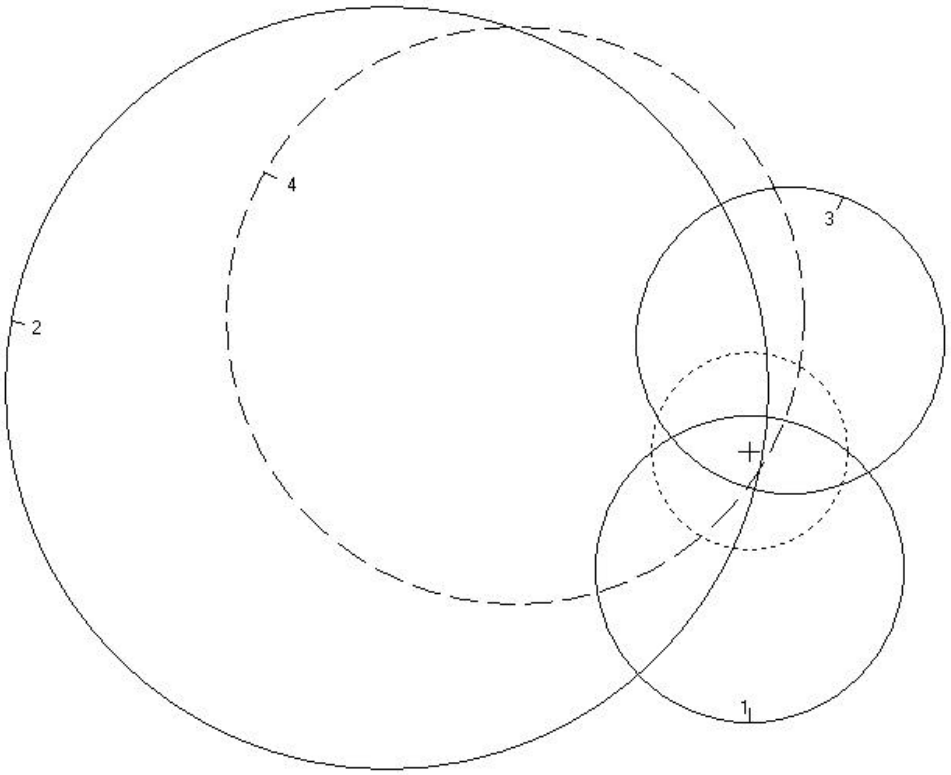
5. There are 4 joint sets around a tunnel of which axis is parallel to north-south. Find joint pyramid codes of removable blocks on a tunnel roof (horizontal plane) and tapered blocks from the following great circles projected by lower-focal-point stereographic projection. (20)

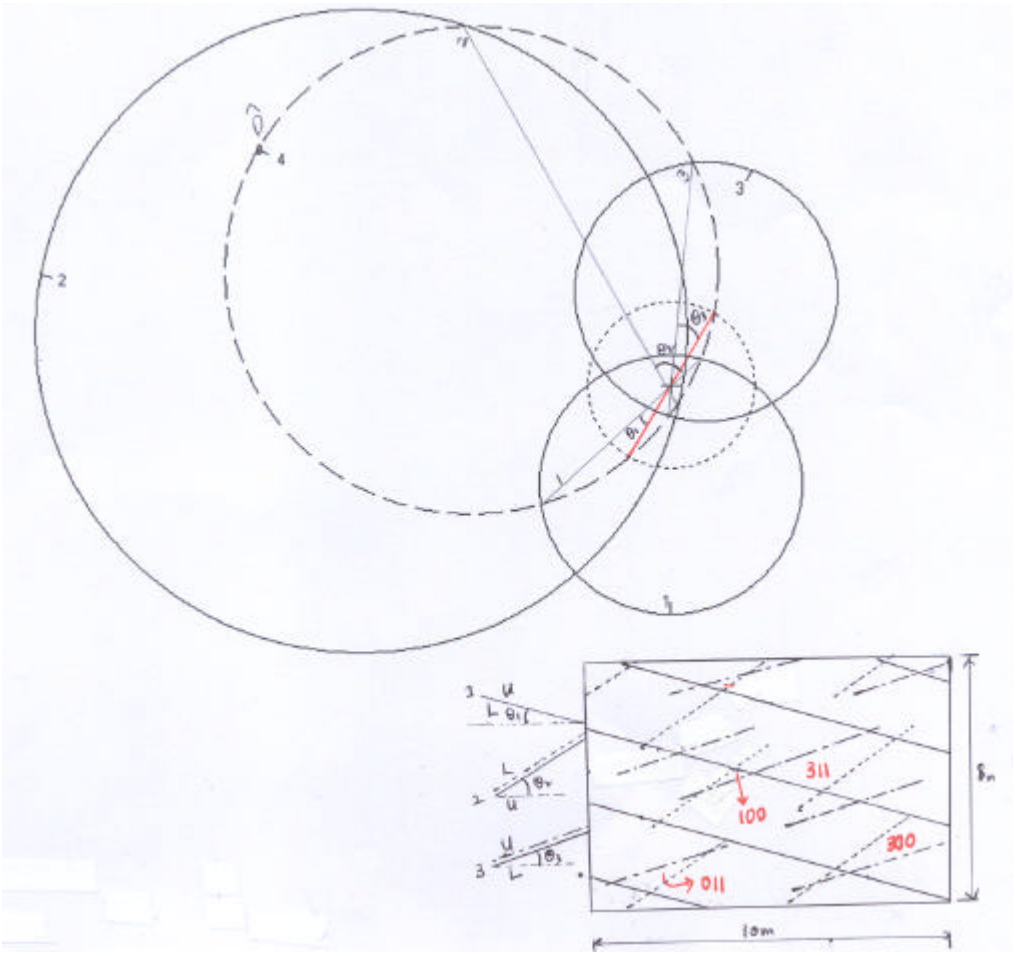


Removable blocks: 1011, 1111, 1110(?), 0111(?)

Tapered blocks: 1001, 0110

6. There are 3 joint sets around a planar rock exposure whose orientation is expressed as a dash-lined great circle in a lower-focal point stereographic projection as below. We installed a rectangular survey window whose width and height are 10 m and 8 m, respectively, on the exposure so that two boundary lines of the window are parallel to horizontal surface. 1) Draw the joint traces of each joint set in the rectangular window when the apparent spacing of each joint on the exposure is about 2 m. 2) Find out several joint pyramid codes of rock blocks observed in the window ignoring the joints possibly intersecting the blocks behind the exposure. Assume that the joints belonging to joint set 1 is large enough that their traces are entirely crossing the window while other joint traces belonging to set 2 and 3 are of 3 ~ 5 m in length in the window. (Key point: to find out the orientation of joint traces from the intersection of great circles) (20)




311
100
300
011
15m