

Final Exam

June 9th, 2021

1. Explain the theorems of finiteness and removability. [15]

2. The great circles below are of the stereographic projection of 4 joint sets whose orientations are shown in the Table. Determine
 - 1) Finite and infinite joint blocks (obtain JP code), respectively, ① when there are no repeated joint sets and ② when the joint set 2 is repeated. [12]
 - 2) Failure mode of each JP when the resultant force on each block is oriented downward (gravitational force). [18]

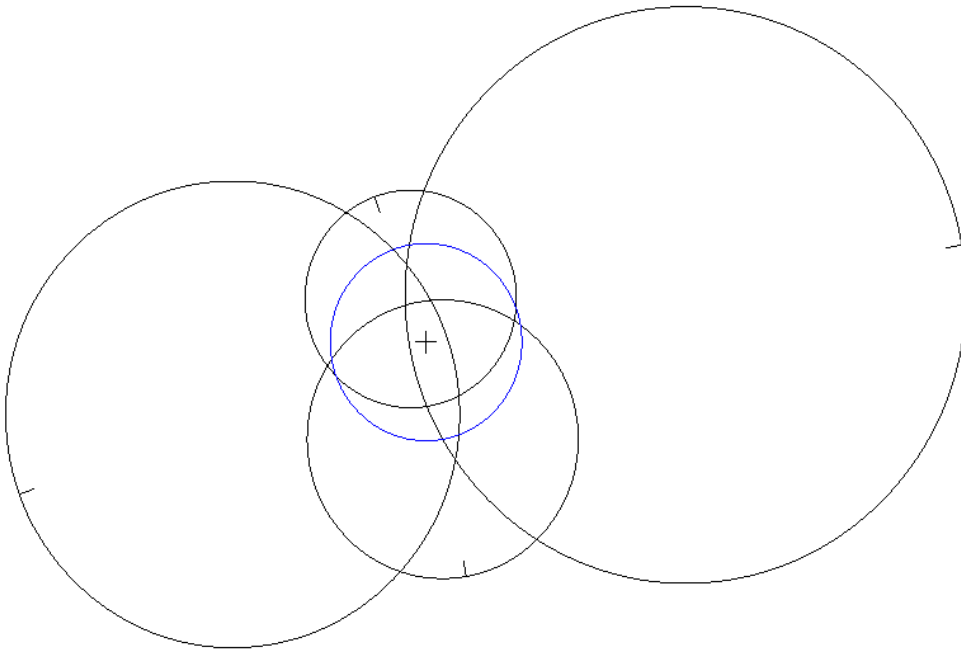


Table. Orientation of 4 joint sets

Set	Dip	Dip direction
1	45	170
2	25	340
3	65	250
4	70	80

3. There are 4 joint sets in a rock slope site of which orientations are as in the Table of Problem 2 (Set 1~4). Draw a trace map on the rock slope ($10\text{ m} \times 6\text{ m}$) whose great circle is expressed as a red circle in the stereographic projection. Assume that the mean trace length of each joint is about 2 m and the joints belonging to the same set are parallel to each other. Let the left of the trace map is toward the north (not exactly north though) and the right toward the south. Express the angle between a joint trace and the horizontal boundary of the trace map as theta ($\theta_1, \theta_2, \theta_3,$ or θ_4) whose relative magnitude are determined from the stereographic projection. Set spacing of the joint traces in the slope can be set randomly from 2 m to 4 m. Show $\theta_1, \theta_2, \theta_3,$ and θ_4 not only in the trace map but also in the stereographic projection additionally provided for this problem (submit the projection sheet too). [25]

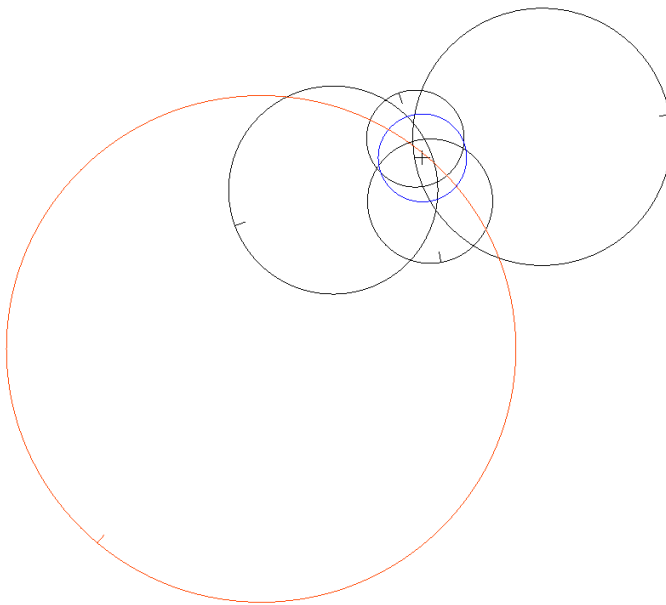
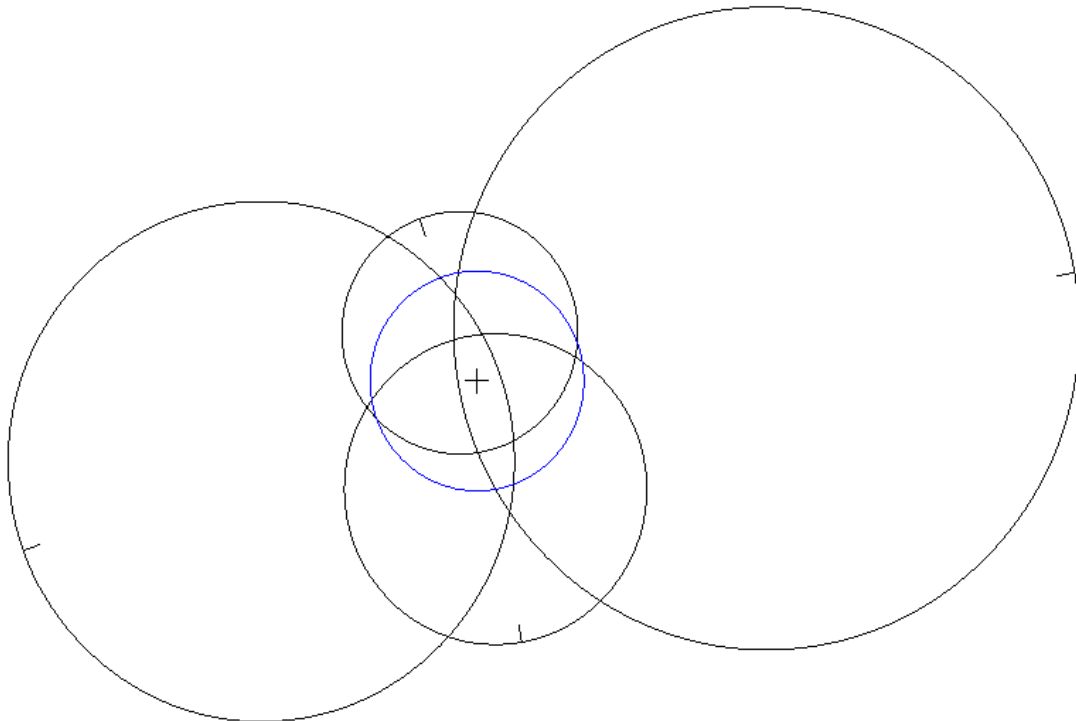


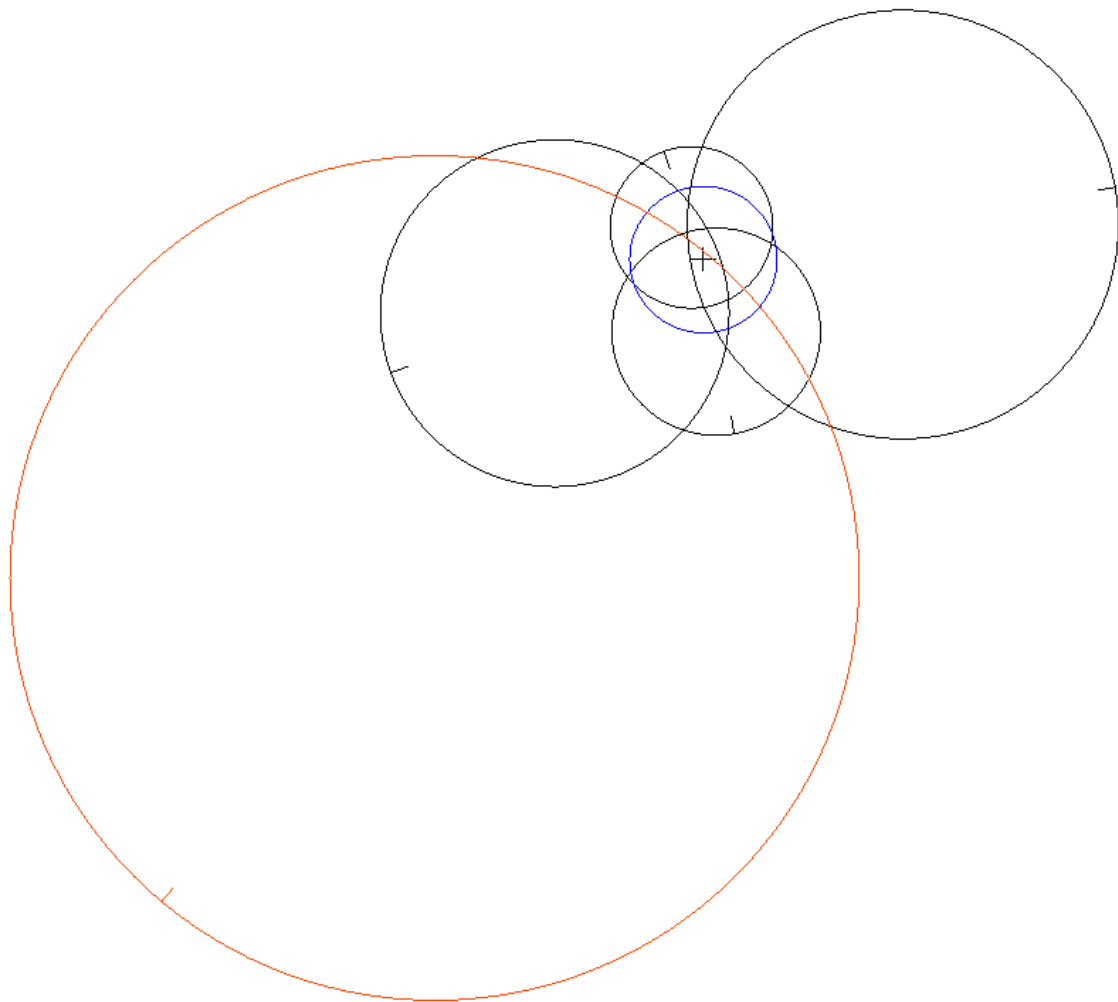
Table. Orientation of 4 joint sets and a free plane (rock slope)

Set	Dip	Dip direction
1	45	170
2	25	340
3	65	250
4	70	80
Slope (red)	80	220

4. A circular tunnel is excavated horizontally from the east to the west in rock mass which has 4 joint sets as in Problem 2. 1) Find out JPs of infinite blocks and 2) draw the 2D maximum removable area of a block whose JP is '1011' with the tunnel in the vertical section normal to the tunnel axis. Express the angles between a horizontal line and boundary lines of the maximum removable area as θ_1 and θ_2 read from the stereographic projection below (submit this page too). 3) Calculate the angles: θ_1 and θ_2 . [30]



Stereographic projection of the discontinuities for Problem 3 (submit this sheet)



Additional stereographic projection map for Problem 2

