HW-3b: Stress State, Mohr Diagrams, and Coulomb Failure

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| --- | --- | --- | --- | --- |
| PT | $σ\_{1}$(MPa) | $σ\_{3}$ (MPa) | $$\frac{σ\_{1}+σ\_{3}}{2}$$ | $$\frac{σ\_{1}-σ\_{3}}{2}$$ |
| A | 13 | 7 |  |  |
|  | 15 | 7 |  |  |
|  | 17 | 7 |  |  |
|  | 19 | 7 |  |  |
| B | 21 | 7 |  |  |

Consider the following compression experiment. The maximum principal stress $(σ\_{1})$ is increased while the least principal stress $(σ\_{3})$ is held constant.



Figure 1: Sketch of experiment. The maximum principal stress is increased while the least principal stress is held constant.

1. Plot this evolving stress state on a Mohr Diagram (Figure 2 top). Label the maximum shear stress. What is the angle of the plane to the maximum principal stress that carries the maximum shear stress?
2. Plot this evolving stress state on an average stress (s) vs. maximum shear stress plot (t) (Figure 2 bottom).

1. The rock fails when $σ\_{1}$ reaches 21 MPa.
	1. Plot the Coulomb failure surface on Figure 2, top. Calculate the friction angle $\left(ϕ\right). $Calculate the angle of this failure surface relative to the orientation of $σ\_{1}$.
	2. On Figure 2, bottom. Draw a line from the origin to Pt. B. Calculate the slope of this line and determine the friction angle.

$$\frac{t}{s}=sinϕ$$



Figure 2: Mohr Diagram.