Brittle deformation and faulting
Lecture 11.4 - Mohr-Coulomb criterion I

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Goals of this lecture

- Present the Mohr-Coulomb criterion and its common representation as a Mohr circle
Mohr-Coulomb criterion

- Amonton’s law, as we saw it, **does not account for rock cohesion**

\[ \tau_{fs} = f_s \sigma_n \]

- Including **cohesion** \( c \) we can modify Amonton’s law to

\[ \tau_{fs} = c + f_s \sigma_n \]

- This is known as the **Coulomb criterion**
Mohr-Coulomb criterion

Mohr found an elegant graphical representation of the Coulomb criterion that illustrates numerous items of interest, including:

- The failure envelope, cohesion and internal angle of friction

\[ f_s = \tan \phi \]

The critical shear stress (failure)

\[ \tau_{fs} = c + f_s \sigma_n \]

Fig. 5.6, Stüwe, 2007
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Mohr-Coulomb criterion

Critical shear stress (failure)

\[ f_s = \tan \phi \]

\[ \tau_{fs} = c + f_s \sigma_n \]

\[ \sigma_{S}^{\text{max}} \]

\[ \sigma_S \]

\[ \sigma_n \]

\[ \sigma_1 \]

\[ \sigma_3 \]

\[ (\sigma_1 - \sigma_3) \]

\[ (\sigma_1 + \sigma_3) \]

\[ 2\theta \]

Fig. 5.6, Stüwe, 2007
Mohr-Coulomb criterion

- Plotting the state of stress of a rock as a circle with a diameter of \((\sigma_1 - \sigma_3)\), failure will occur if/when the circle intersects the failure envelope

- In this case, failure occurs at critical shear stress \(\tau_{fs}\)
Let’s see what you’ve learned…

- If you’re watching this lecture in Moodle, you will now be automatically directed to the quiz!