Yield behavior of sand under generalized stress conditions

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Introduction

Yielding of soil foundation

Matsuoka-Nakai

\[
\frac{J_1 J_2}{J_3} = \text{Constant}
\]

Lade

\[
\frac{J_1^3}{J_3} = \text{Constant}
\]
Test Program: Leighton Buzzard sand

Stress state

Segments of yield surfaces

BE and FK are segments of yield surfaces

Sample isotropically consolidated to Point A

Points B and F are initial points on yield surfaces

Typical stress path

Effective stress ratio, R'

Intermediate principal stress parameter, b
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Findings

Graphs showing the yield behavior of sand under different stress conditions. The graphs compare Lade Normalized Constant and Matsuoka-Nakai Normalized Constant under various angles of stress (0°, 30°, 60°, 90°). The graphs illustrate how the normalized constants change with respect to the stress parameter (b).
Conclusions

• Stress paths identify segments of different yield surfaces in generalized stress space using hollow cylinder apparatus

• Matsuoka-Nakai and Lade yield criteria both adequately predict onset of yielding under generalized stress conditions

• Experimental yield surfaces indicate yield predictions predominately independent of rotation of major principal stress during initial consolidation stage