Verification - Example 5: Intersecting joint with tunnel

Problem Description

This verification example demonstrates a circular excavation inside an infinite domain, intersected with a joint.

The stiffness of the top and bottom layers are the same, which is different with the middle layer.

Model Information

Material properties:

Young's Modulus	5000 MPa
Poisson's Ratio	0.3
Tunnel Radius	4.0 m
Field stress (horizontal)	4.0 MPa
Field stress (vertical)	8.0 MPa
Joint normal stiffness	100 GPa/m
Joint shear stiffness	100 GPa/m

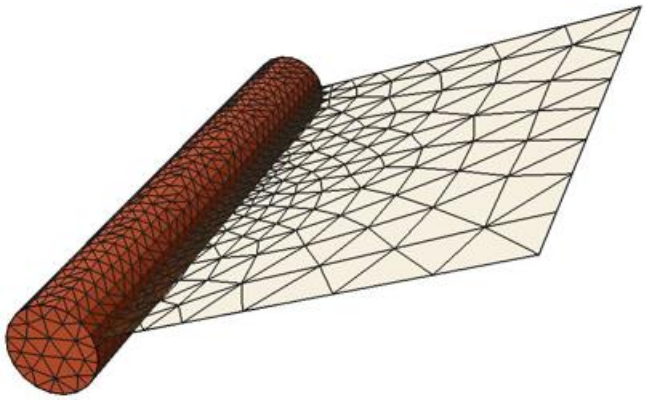
Comparing the normal and shear stress along the joint with the analytical solution

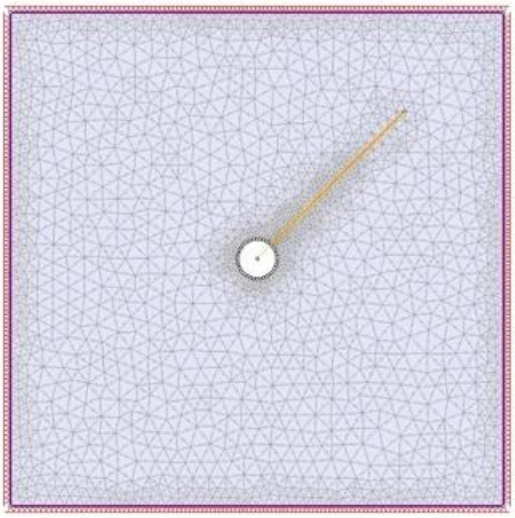
Analytical Solution

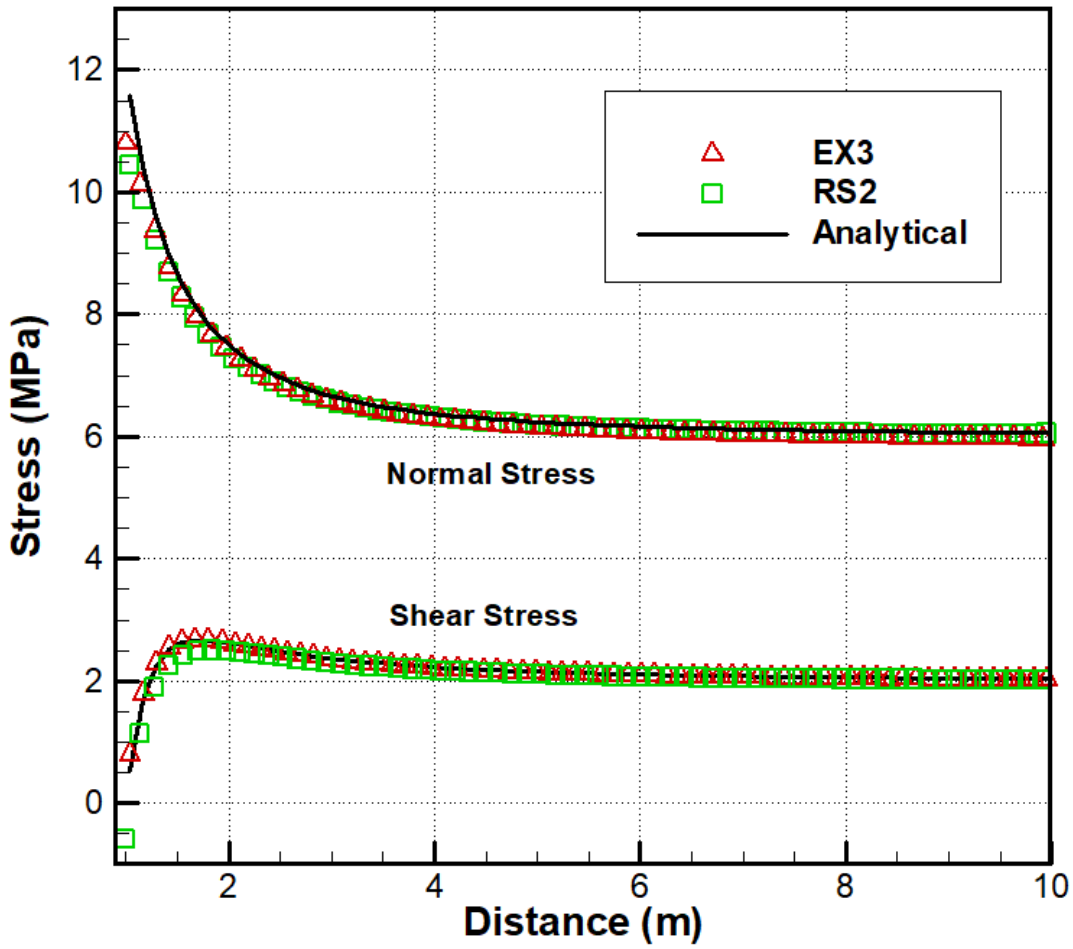
- $\sigma_n = \frac{P}{2}\left[(1+k)\left(1+\frac{a^2}{r^2}\right) + (1-k)\left(1+\frac{3a^4}{r^4}\right)cos2\beta\right]$
- $\tau = \frac{P}{2}\left[(1-k)\left(1+\frac{2a^2}{r^2}-\frac{3a^4}{r^4}\right)sin2\beta\right]$

Here 'a' is the radius of tunnel, 'r' is distance from the center of tunnel, 'k' is the ratio of horizontal to vertical field stress (in this example 0.5) and β is the direction of intersected joint with horizontal direction (in this example 45 degree).

Results







References

Deb, Debasis & Das. Kamal Ch (2010), “Extended finite element method for the analysis of discontinuities in rock masses”. Geotech. Geol. Eng., Vol. 28, pp. 643-659

Data Files

The data input file(s) and file for the finished model can be found in the EX3 installation folder.