

# Verification - Example 1: Stress variation around the cylindrical tunnel

## Problem Description

This verification compares radial and tangential stresses with analytical solution in a horizontal direction. It assumes the tunnel exists in an infinite domain.

## Model Information

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- The tunnel's radius is  $a = 2.5$  m.
- A constant 10MPa field stress in domain is assumed.
- Host rock material property:
  - $E = 2000$  MPa,  $\nu = 0.25$

## Analytical Solution

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$$\sigma_{rr} = \frac{P}{2} \{ (1+k)(1-\beta^2) + (1-k)(1-4\beta^2+3\beta^4)\cos 2\theta \}$$

$$\sigma_{\theta\theta} = \frac{P}{2} \{ (1+k)(1+\beta^2) + (1-k)(1+3\beta^4)\cos 2\theta \}$$

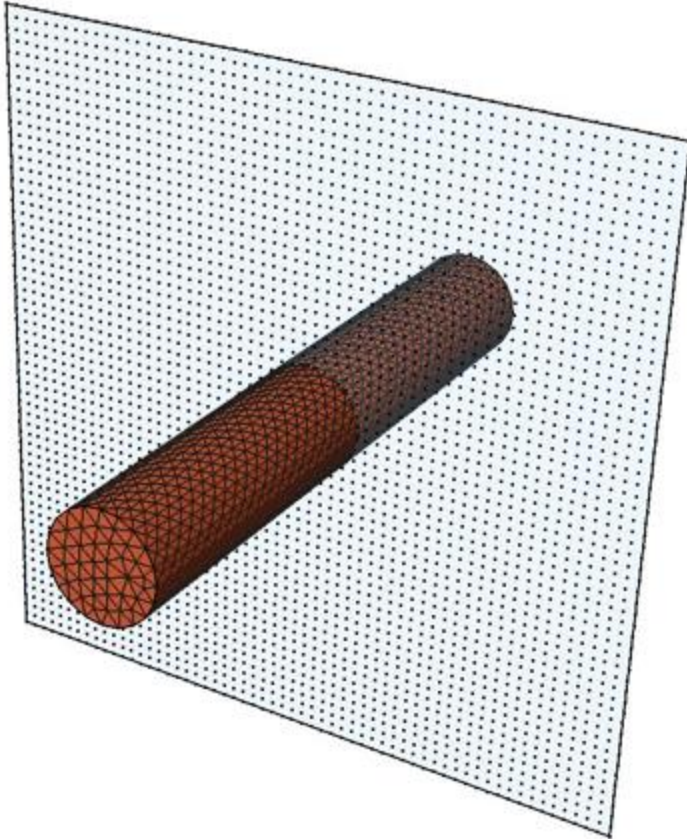
$$\sigma_{r\theta} = \frac{P}{2} \{ (1-k)(1+2\beta^2-3\beta^4)\sin 2\theta \}$$

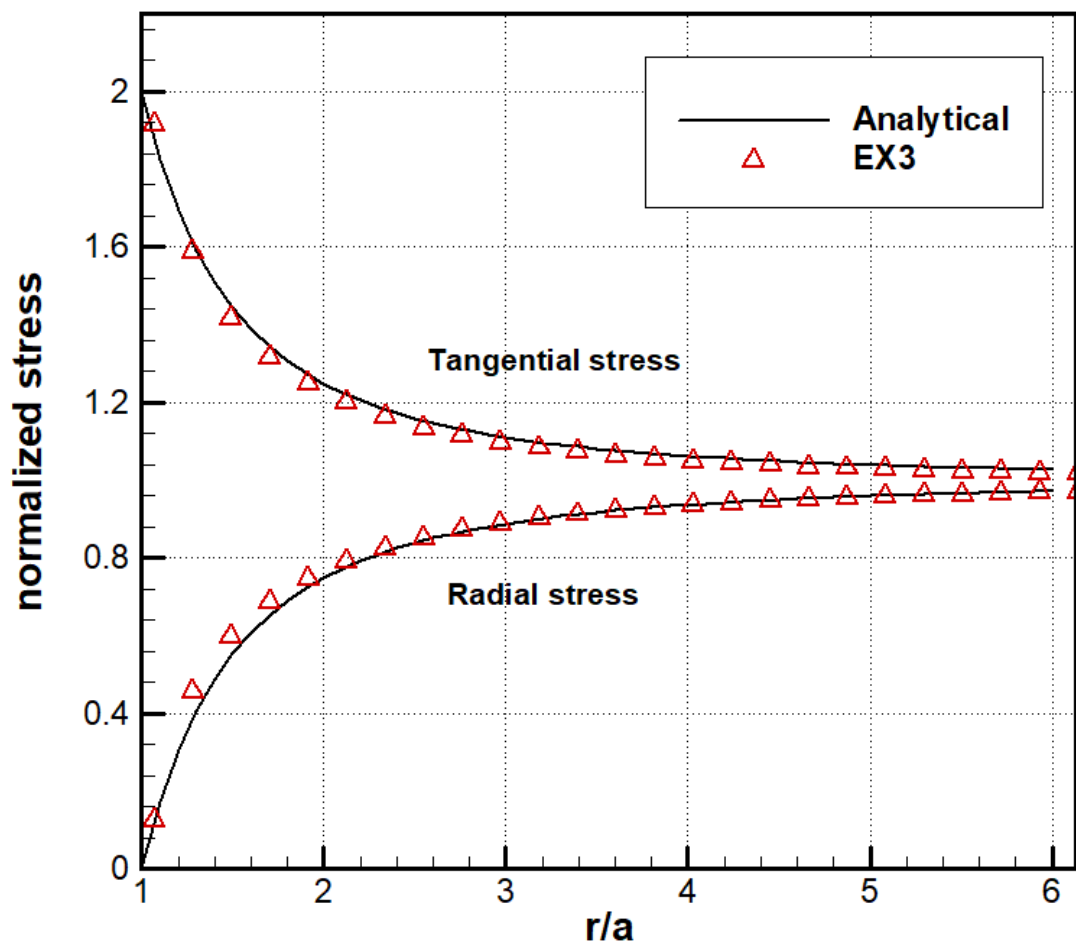
Here  $\beta = \frac{a}{r}$  and  $\theta$  is the angle with horizontal direction.

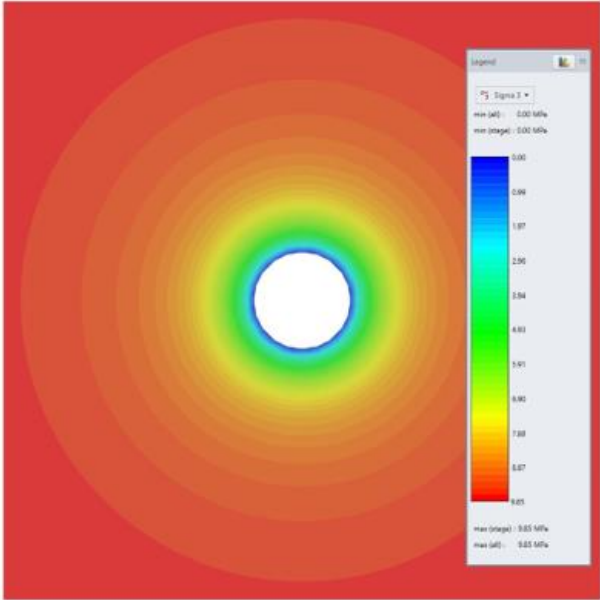
## Results

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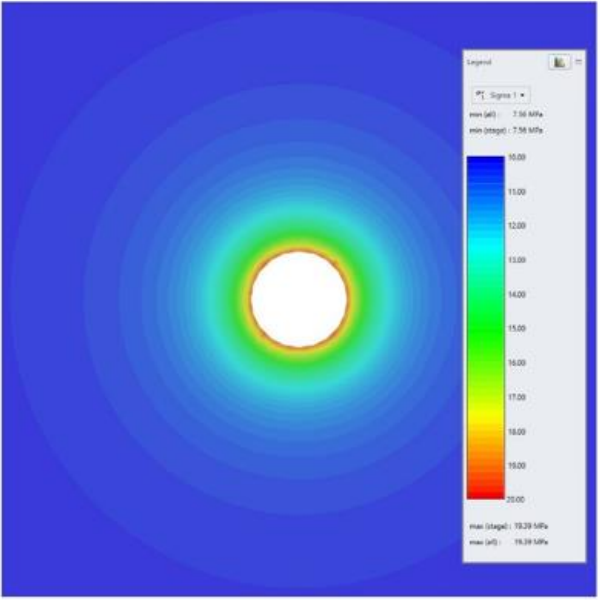
Results are calculated from the surface of tunnel to the distance of 15.0m ( $a < r < 15.0\text{m}$ )



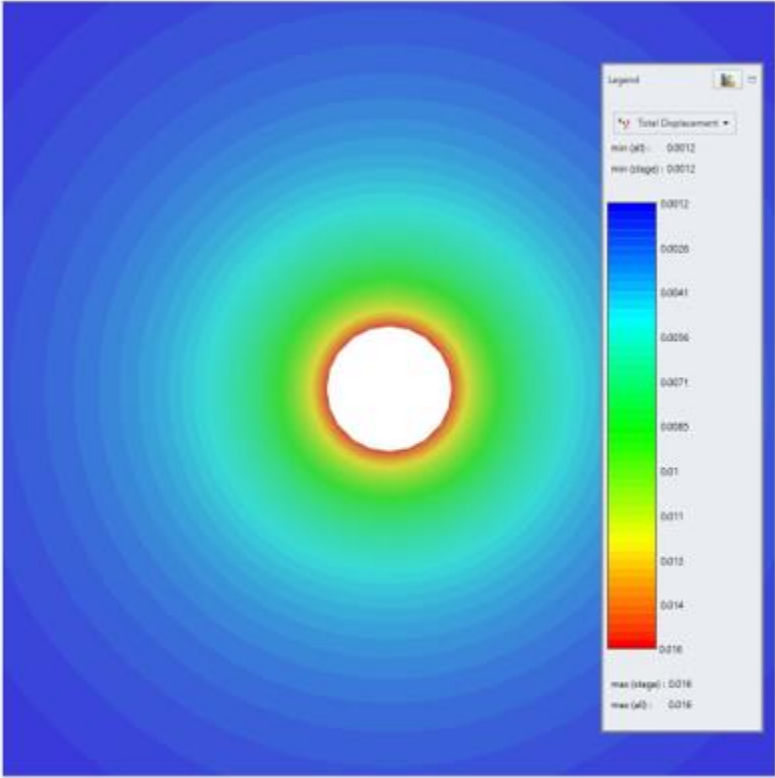




Radial Stress



Tangential Stress



Total Displacement

## References

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Brady, B.H.G and Brown, E.T (1985) Rock Mechanics for Underground Mining, Chapman & Hall, London.

## Data Files

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