

Worked Example 4

Subsurface stress: frictionless and frictional

The engineering question

The same Hertz-type pressure field is used to calculate stresses below body 1 with no tangential traction and with COF = 0.5. Comparing the two cases shows how sliding traction raises the equivalent stress and shifts the critical region toward the surface.

What the model represents

This example uses the production model selected by the supplied input. The governing theory and assumptions are described in the TriboSolver Manual; here the emphasis is on setting up, reproducing and interpreting one complete calculation.

Input or control	Reproducible value
Simulation type	Dry Contact + Calculate subsurface stresses for Body 1
Normal load	1 N
Primary input	COF = 0.50; Include Friction checked
Variant	COF = 0; Include Friction clear
Domain and grid	100 x 100 um; 64 x 64; 33 depth locations to 60 um
Result variable	Von Mises subsurface stresses, Body 1

Supplied input: `subsurface-stress.tribo.json`
SHA-256: d7dcdee5a47a939ec3349c401e9f00a47571a1c6aa99d979ebbe643e290bc9f1

Set up and run the story

Step	Tab	What to do and why
1	Simulation Type	Choose Dry Contact and check Calculate subsurface stresses for Body 1.
2	Solid Material Model	Use steel for both bodies; no coating in this example.
3	Contact Conditions	For the frictional case check Include Friction and enter 0.50. For the frictionless variant clear it and set COF to 0.
4	Contact Grid	Set X = 64, Y = 64, body-1 depth = 60 um and 32 depth intervals.
5	Macro Geometry	Choose Point Contact with 5 mm radius.
6	Run	Run and save each case separately. Use the supplied variants/01_Frictionless input for the zero-friction calculation.
7	Results	Select Von Mises subsurface stresses, Body 1. Choose the 2D tab, set All X, a fixed center Y and All Z, then press Plot.

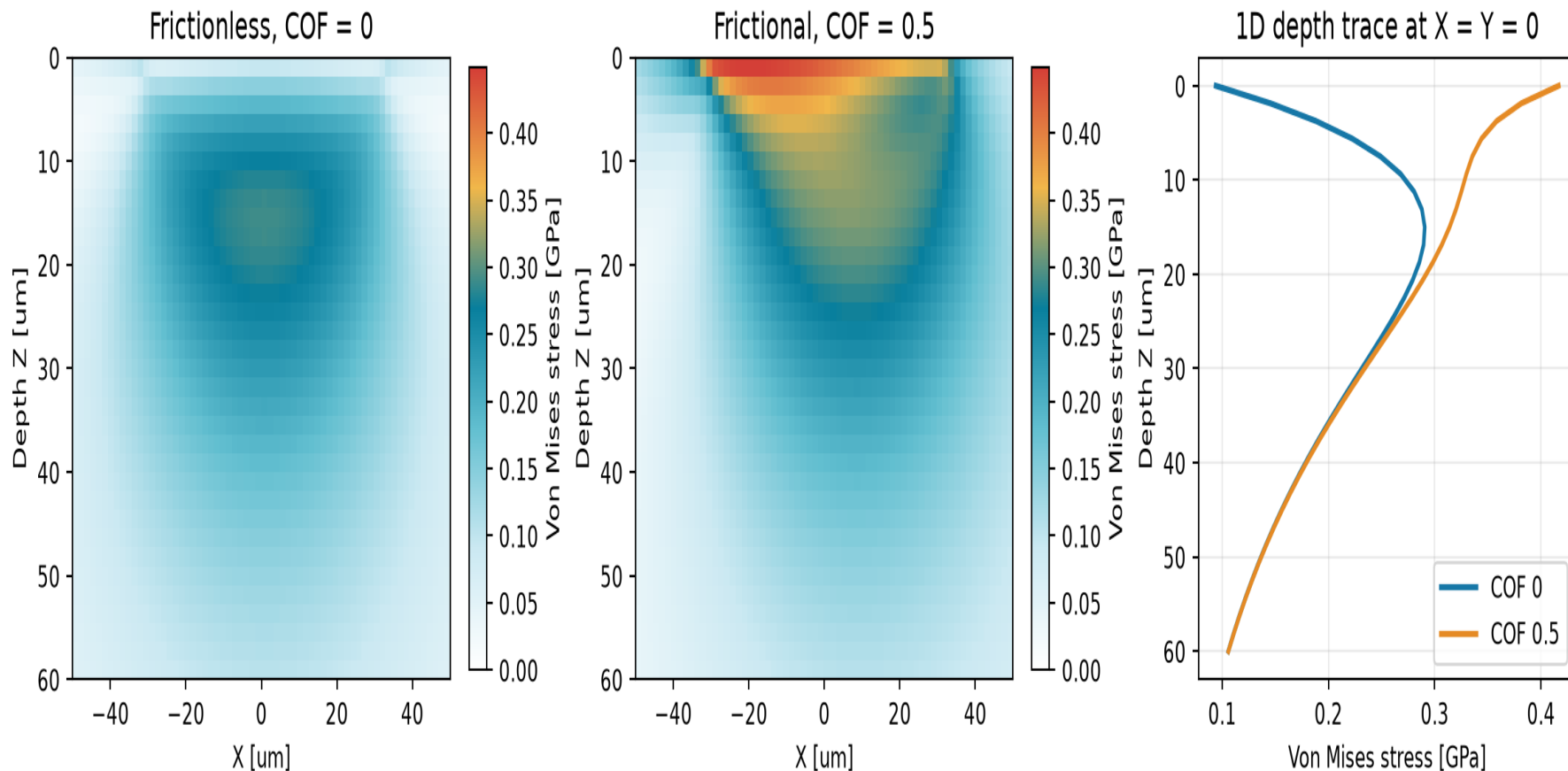
Run checkpoint

Do not interpret a field until the status reports success. Compare the summary below with your run; it was read from the retained result set created from this exact input.

depth 5.625 um | solved grid 64 x 64 x 33

Calculated result

Subsurface stress comparison from the supplied inputs



Reproduced calculation: depth 5.625 um | solved grid 64 x 64 x 33

The X-Z maps use true physical coordinates without forcing equal screen scale. In the frictionless case the highest von Mises region sits below the surface. With COF = 0.5, tangential traction increases the peak and moves it closer to the surface. A vertical 1D trace answers 'how does stress change with depth at this X/Y?'; the X-Z map answers 'where is the critical subsurface zone?'.

How to explore and explain the result

In 1D, start with the default center cross-section. Choose X or Y only when the engineering question requires a different direction, then move the location control. The grid and cursor readout give the plotted value and its unit. In 2D, use the colorbar to locate high and low regions and read the numerical X/Y axes. In 3D, rotate the same matrix to understand peak prominence and orientation; the X, Y and Z directions are references, not a different calculation.

View	Question it answers	Reading rule
1D	What happens along one selected line?	Start at the center; use the grid and cursor value to quantify peaks, widths and gradients.
2D	Where are high, low or active regions?	Read the colorbar and X/Y units; compare runs only with their numerical scales visible.
3D	How prominent and oriented are the features?	Rotate for shape and orientation; use 1D/2D or export for exact values.

What to report

State the input filename and hash, simulation type, material and geometry, grid and surface definition, prescribed load, solver status, iteration or balance measure, selected output name and unit, and the engineering meaning of the plotted pattern.

A useful engineering explanation states the prescribed load and geometry, identifies the active physical mechanism, checks convergence or force balance, and only then interprets the spatial field. Keep the supplied input and retained result together so a colleague can reproduce every number and plot.

Retained result: subsurface-stress-results.tribo-results.json
SHA-256: 9c73da28fe18d5cbfc7096b1c46b12815225ff6bcc9897f3b2c248925a3bc6c8