

Worked Example 7

Rough adhesive contact

The engineering question

A rough point contact carries compressive elastic pressure while a finite-range surface interaction generates tensile pressure outside or around the hard-wall contact patches. The load-controlled adhesion solver balances both contributions simultaneously.

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	Adhesion
Normal load	1 N
Adhesion controls	Adhesion checked; Electroadhesion clear
Work of adhesion	0.05 J/m2
Interaction range	0.275 nm
Surface	512 x 512 generated PSD; Sq 6.3 nm; seed 314159

Supplied input: `adhesion.tribo.json`
SHA-256: a17d032b06a0d62ec71e6f66e95878c12b0792bb17d62cdd8196a4b5610865c3

Set up and run the story

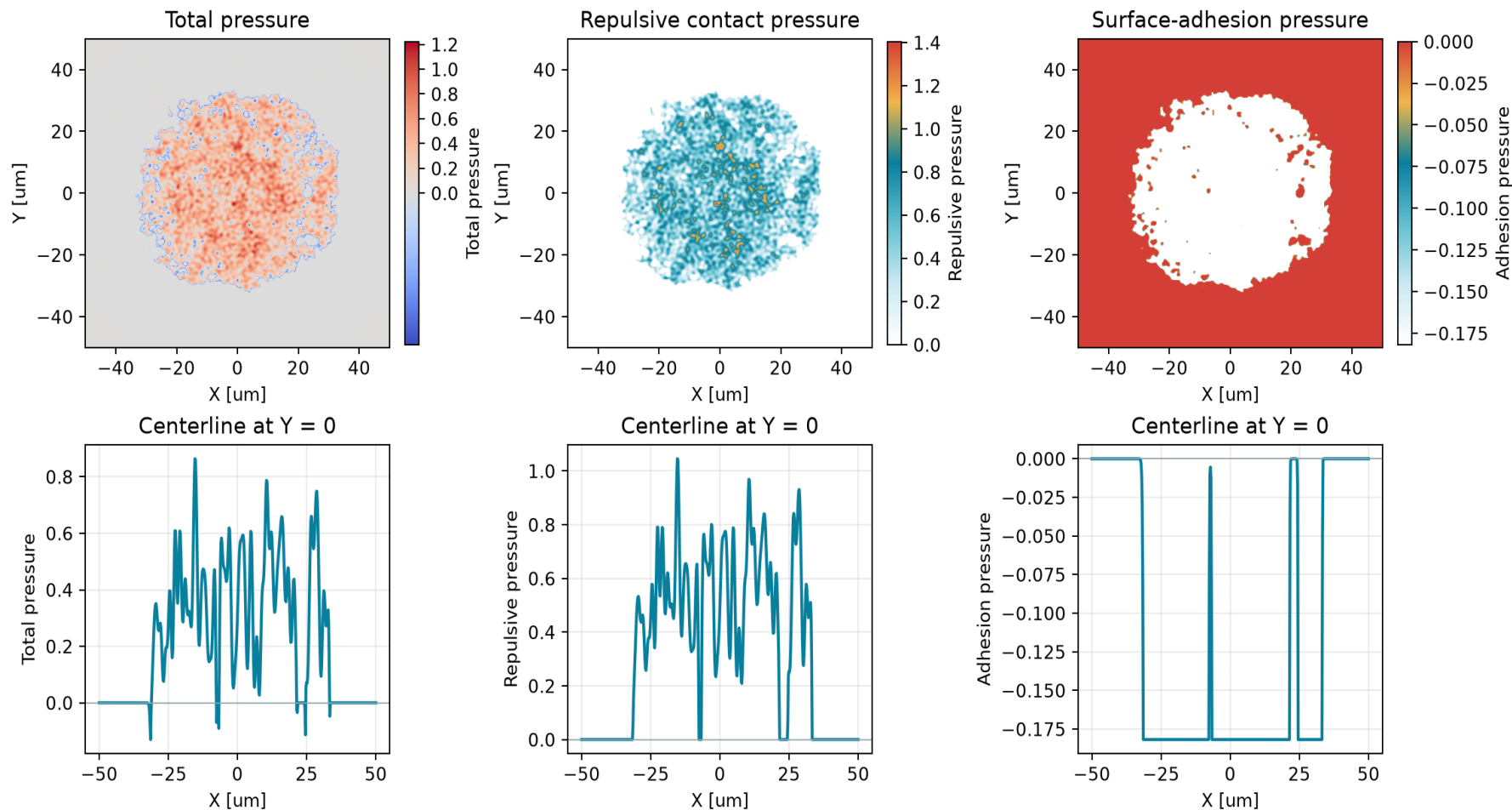
Step	Tab	What to do and why
1	Simulation Type	Choose Adhesion.
2	Solid Material Model	Use steel/steel; coatings are disabled in this example.
3	Contact Conditions	Set the normal load to 1 N.
4	Contact Grid/Macro Geometry	Use 512 x 512 and Point Contact with 5 mm radius.
5	Micro Geometry	Generate the fixed-seed PSD surface and confirm the preview.
6	Adhesion	Check Adhesion only. Enter 0.05 J/m2 and 0.275 nm. Electroadhesion controls and outputs should remain hidden.
7	Run	Watch the iteration and load-error progress. A full-domain diagnostic means the chosen numerical domain is too small unless the finite-domain load balance is accepted.

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.

iterations 187 | repulsive force 1.57126 N | adhesion force -0.571257 N | load error 4.90073e-07 | interaction range 0.001408 grid cells | WARNING: adhesive tensile spikes and peak pressure are unresolved

Calculated result



Reproduced calculation: iterations 187 | repulsive force 1.57126 N | adhesion force -0.571257 N | load error 4.90073e-07 | interaction range 0.001408 grid cells | WARNING: adhesive tensile spikes and peak pressure are unresolved

Repulsive pressure is positive and surface-adhesion pressure is negative; their pointwise sum is the total pressure. The integrated repulsive and adhesive forces must leave the prescribed resultant. Zero remains inside a signed color scale. Because the molecular interaction range is much smaller than a grid cell, integrated force is useful here but individual tensile spikes are not claimed as mesh-converged.

Selected calculated scalar outputs

Output	Value	Unit
Total normal force	1	N
Repulsive contact force	1.571	N
Average repulsive contact pressure	0.5047	GPa
Contact area	3.113e-09	m^2
Rigid body motion	-0.06025	um
AdhesionForce	-0.5713	N
Mean gap	0.06025	um
Repulsive contact area	3.113e-09	m2
Relative load-balance error	4.901e-07	-
Contact solver iterations	187	-

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: adhesion-results.tribo-results.json
SHA-256: 8cb22f01585227ab8c403c80fb9af60b35c36054297e006c212537202e750916