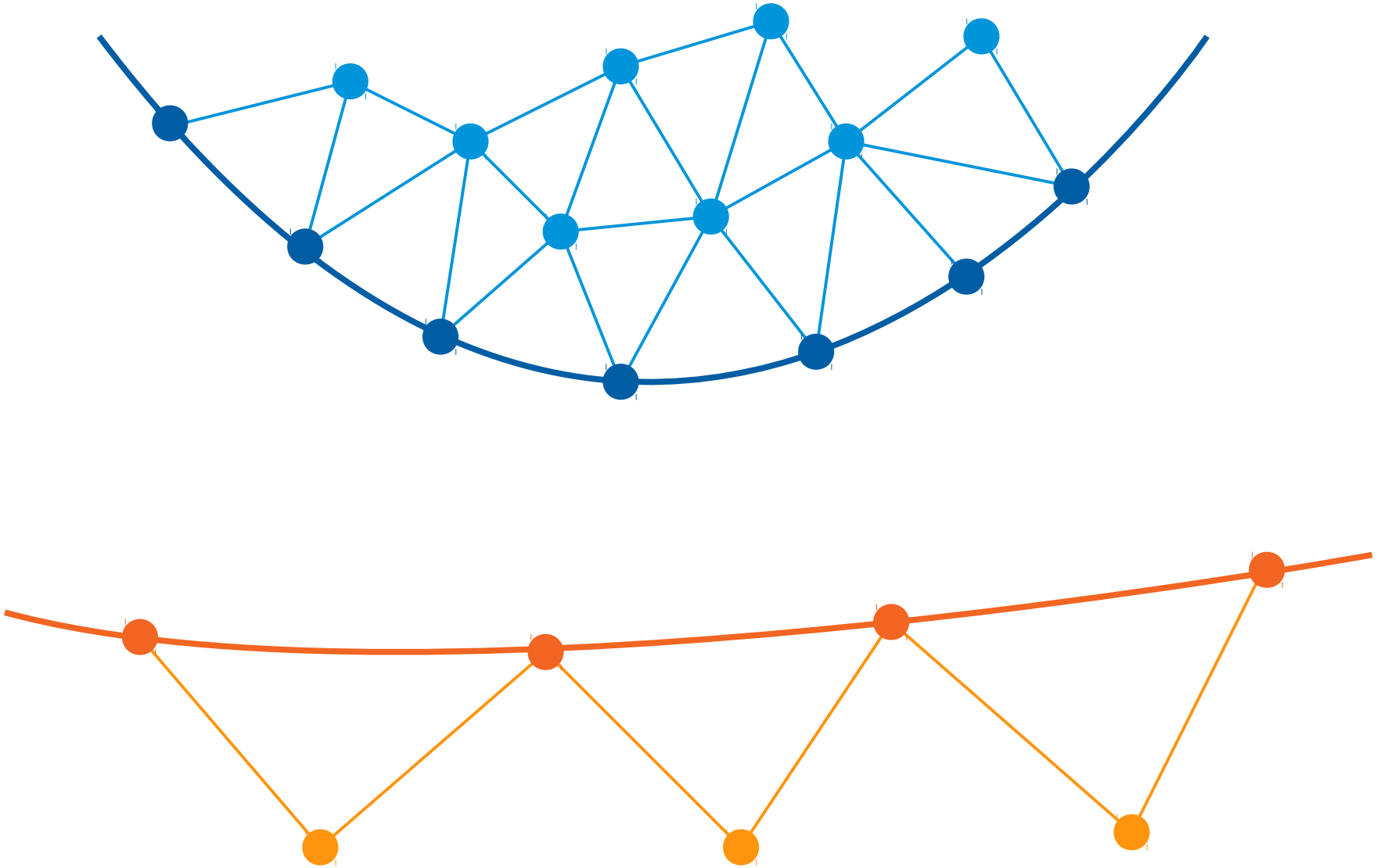
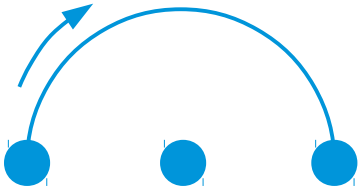
ANSYS Mechanical APDL

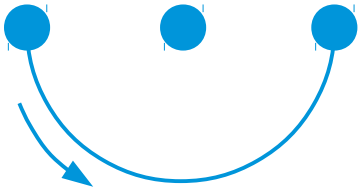
Loads & Boundary Conditions



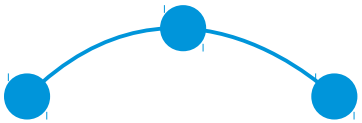
line



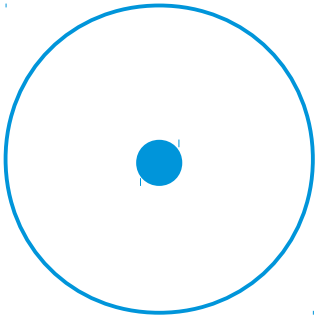
arc, clockwise



arc, anticlockwise



parabola

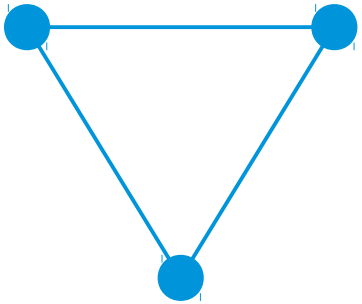


circle

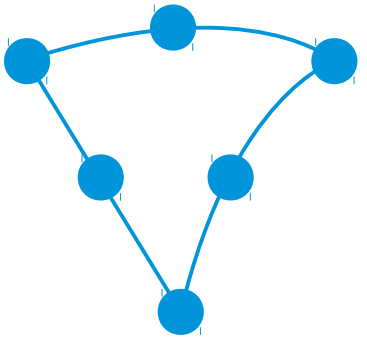
pilot node

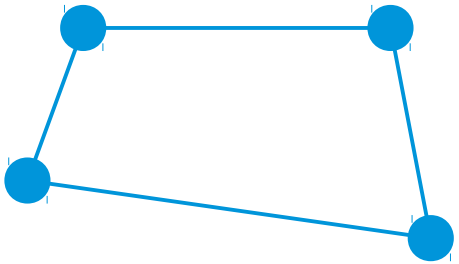
point

TARGET ELEMENTS

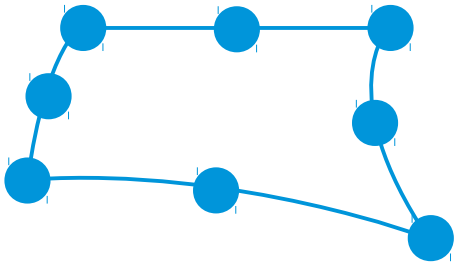


triangle
(higher-order
if curved surface)

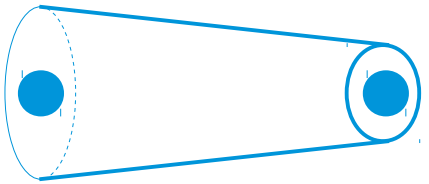




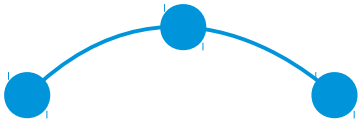
quadrilateral
(higher-order
if curved surface)



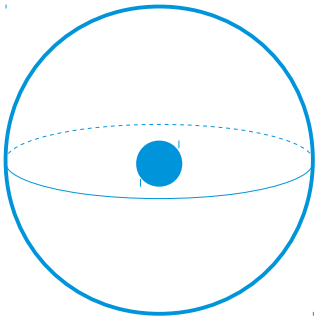
line



cone



parabola



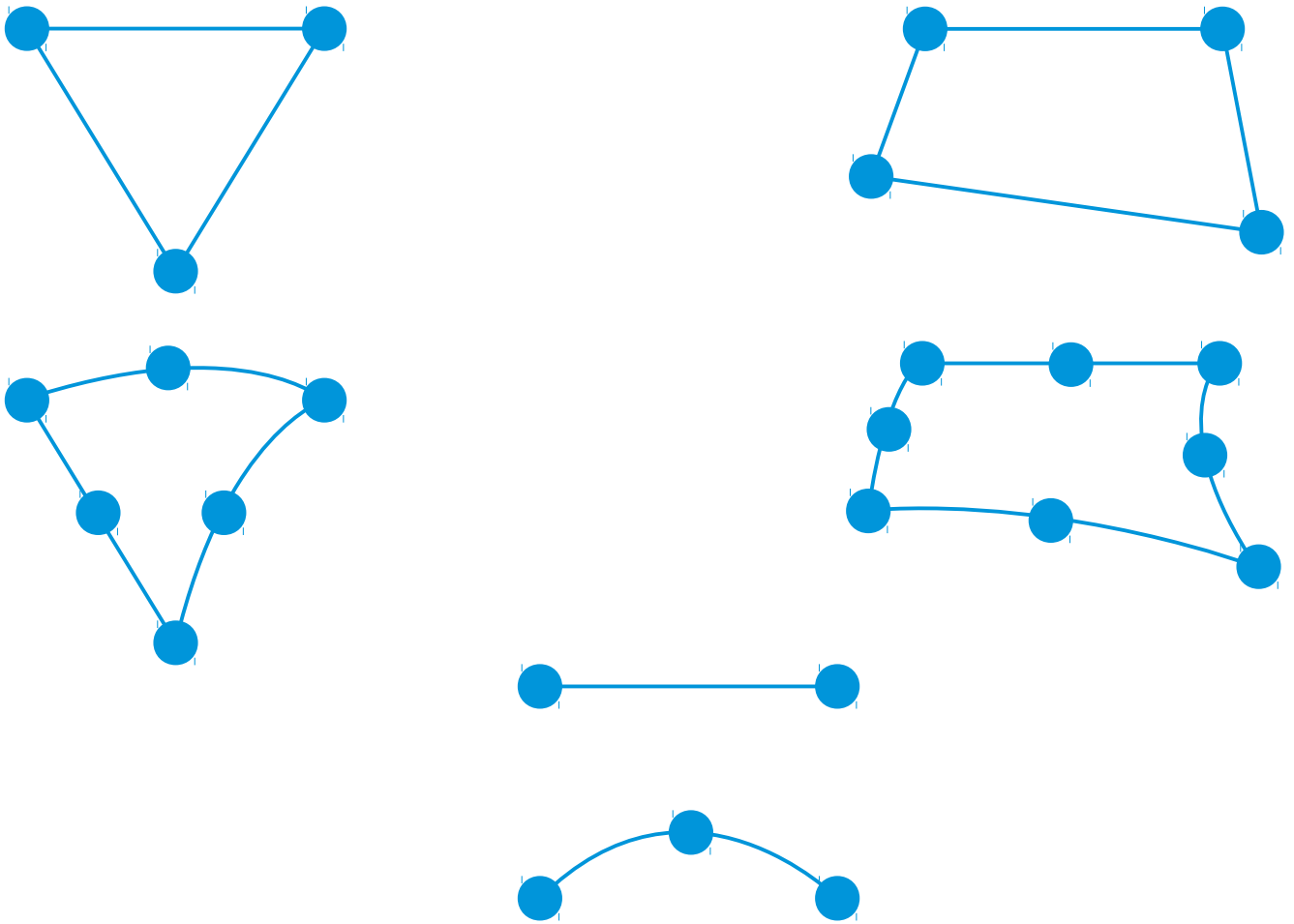
sphere

cylinder

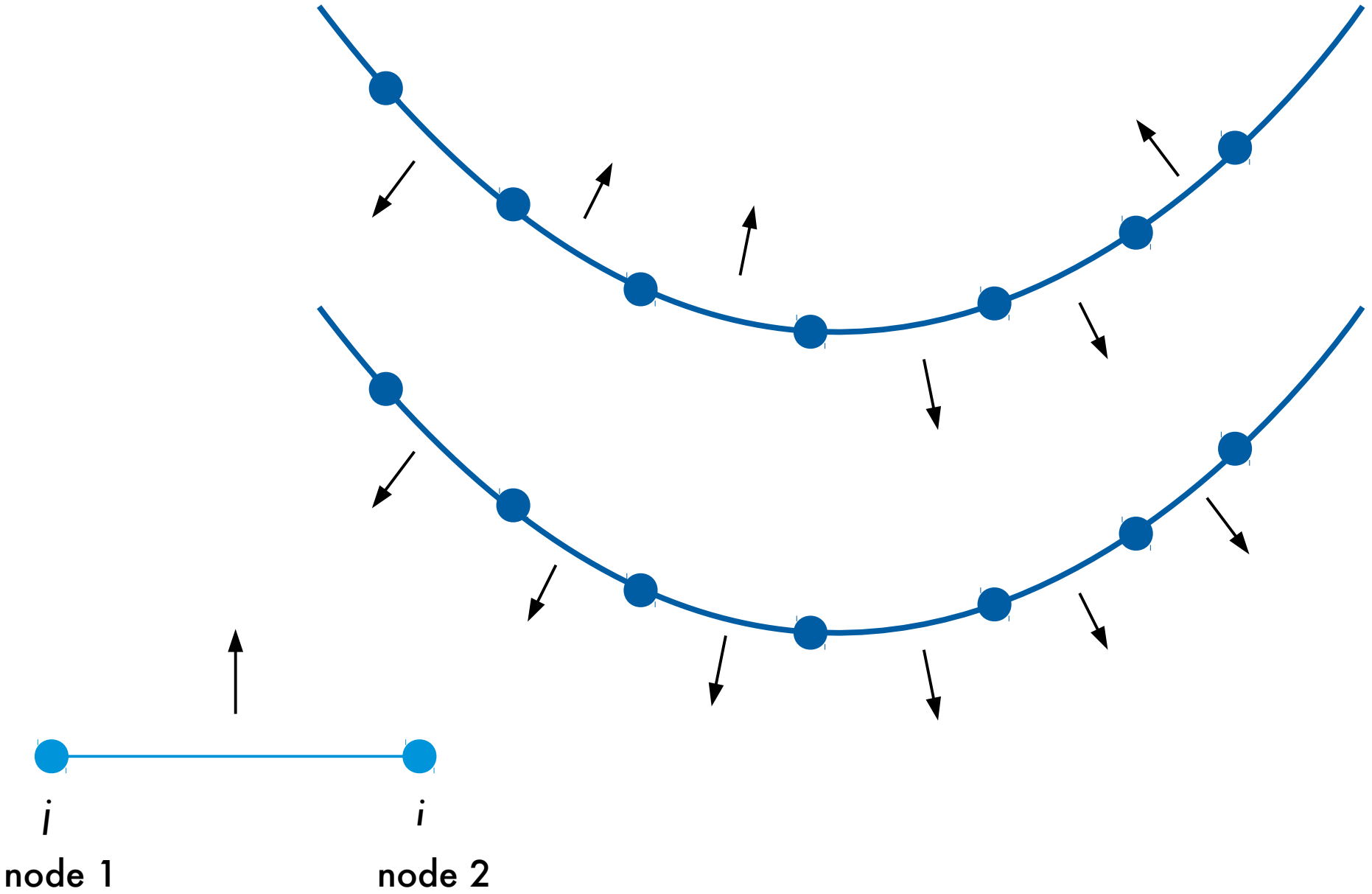
pilot node

point

TARGET ELEMENTS



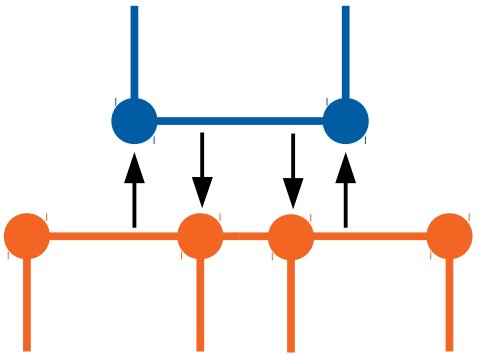
CONTACT ELEMENTS

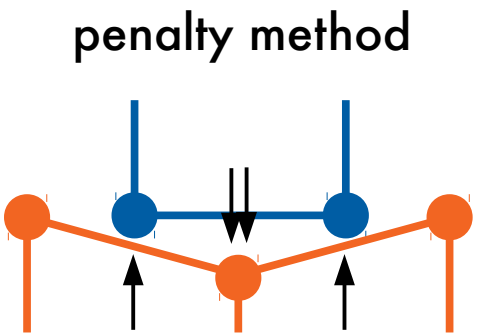

i
i
node 1
node 2

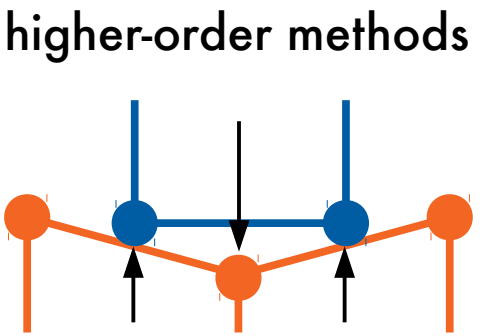
1. Create the model geometry and mesh.
2. Identify the contact pairs.
3. Designate contact and target surfaces.
4. Define the target surface.
5. Define the contact surface.
6. Set the element KEYOPTs and real constants.
7. Define/control motion of target surface (rigid-to-flexible only).
8. Apply necessary boundary conditions.
9. Apply fluid pressure-penetration loads.
10. Define solution options and load steps.
11. Solve the contact problem.
12. Review the results.

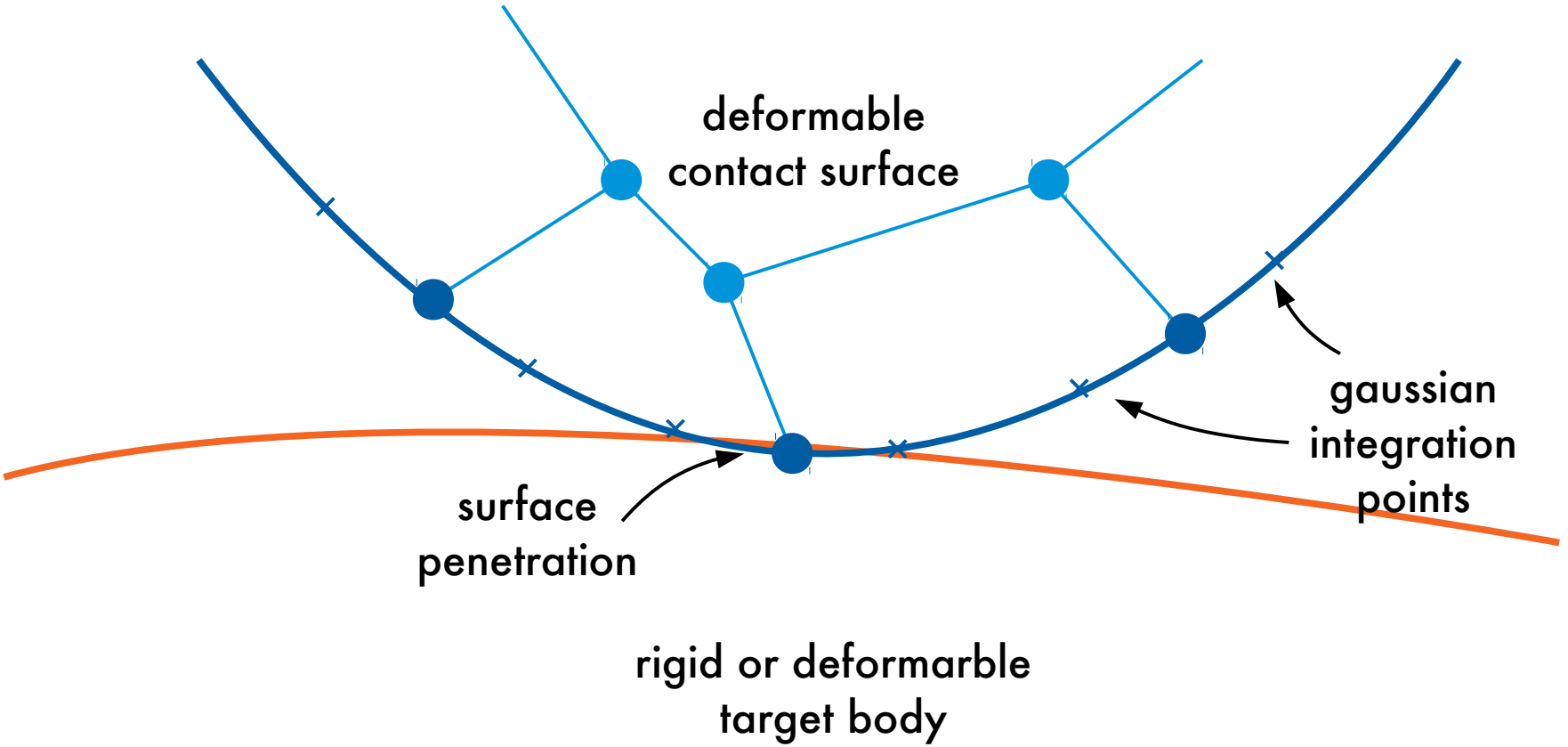
Contact Algorithms

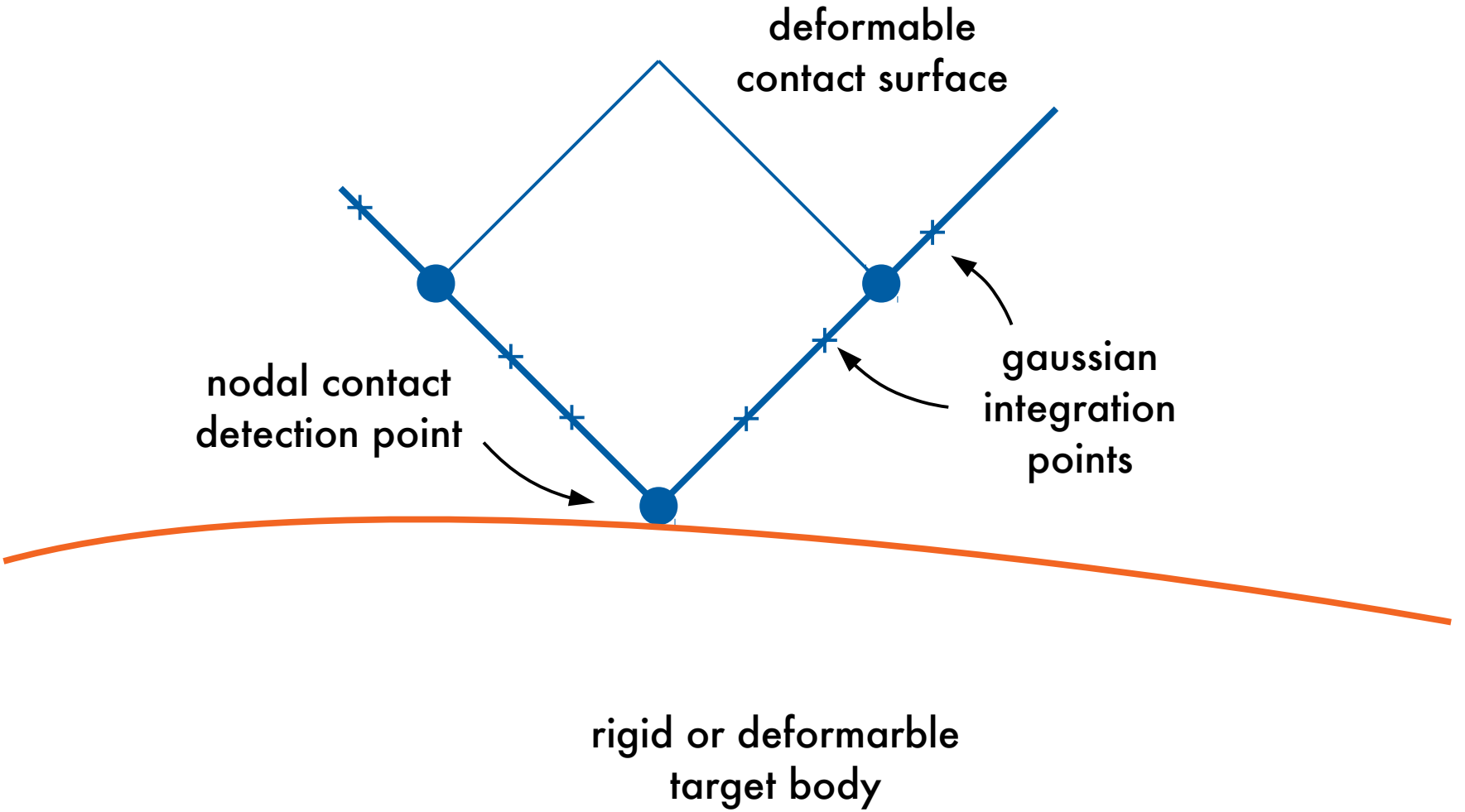
- Penalty method
- Augmented Lagrangian (default)
- Lagrange multiplier (two options)
- Internal multipoint constraint (MPC)








deformable
contact surface
gaussian
integration
points
surface
penetration
rigid or deformarble
target body


deformable
contact surface
nodal contact
detection point
gaussian
integration
points
rigid or deformarble
target body

Friction Algorithms

- Coulomb friction

$$\tau = \mu p + \textbf{COHE}$$

- Exponential decay friction

$$\mu = \textbf{MU} \times (1 + (\textbf{FACT} - 1) \exp(-\textbf{DC} \times V_{\text{rel}}))$$

- Isotropic friction

$$\mu = \sqrt{\frac{(\mu_1^2 + \mu_2^2)}{2}}$$

Surface Contact Models

- standard unilateral contact
- perfectly rough frictional contact without sliding
- no separation contact (several models)
- bonded contact (several models)

- convex in contact with flat or concave:

  flat/concave should be target

- fine in contact with coarse:

  coarse should be target

- stiff in contact with soft: stiff should be target

- higher-order under surface:

  lower-order under surface should be target (2D)

  lower-order under surface should be contact (3D)

- larger in contact with/surrounding small:

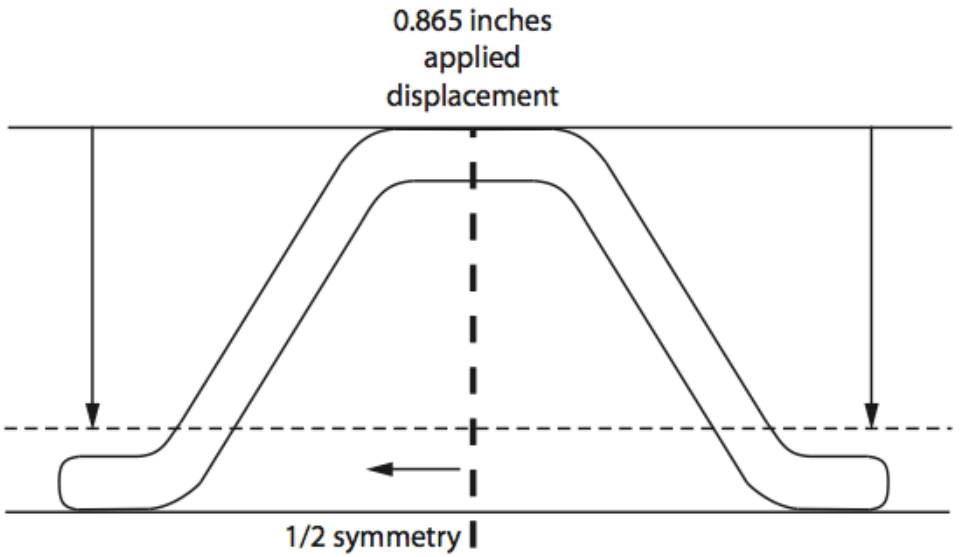
  larger should be target

- In Abaqus terminology:

  contact → slave

  target → master

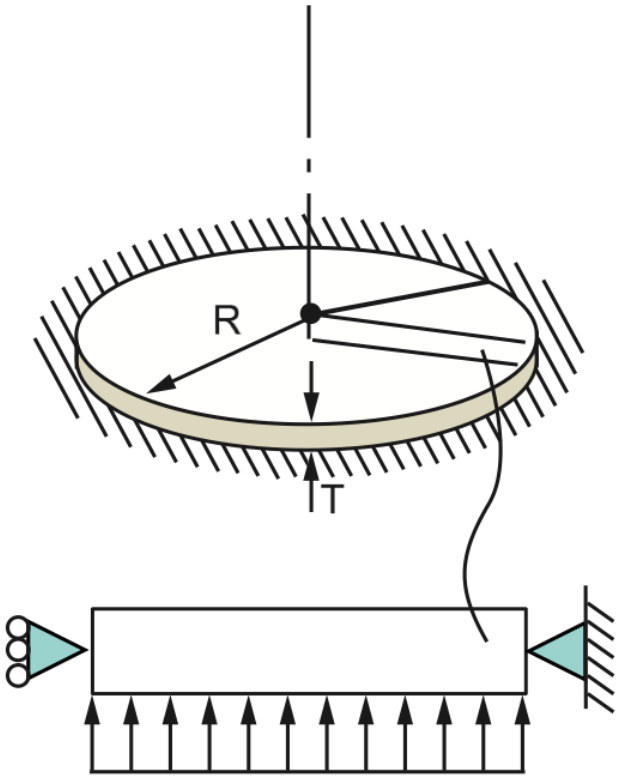
Figure 1: Diagram of Planar Seal Model



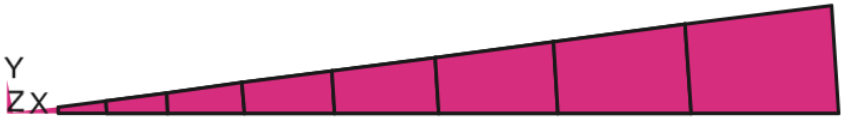
Planar seal example, *ANSYS Mechanical APDL Contact Technology Guide*, pp. 171–177.

A flat circular membrane made of a rubber material is subjected to uniform water pressure. The edges of the membrane are fixed. Determine the response as pressure is increased to 50 psi.

Figure 218.1: Hyperelastic Circular Plate Project Sketch



Problem Sketch



Representative Finite Element Model

Material Properties	Geometric Properties	Loading
C_1 = 80 psi C_2 = 20 psi	R = 7.5 in T = 0.5 in	Pres = 50.0 psi