Collision with kinematic (or static) collision objects

Deformable body

(static) Collision body

• → collision "proxy" (on surface)
• → collision proxy in active collision

For simplicity (or economy...) we may choose to detect/respond to collision just on surface "proxy" locations (e.g. particles on surface of tetrahedral mesh).

Generally (with some caveats...) the elasticity of the body will prevent other parts of the elastic volume from penetrating into the collision body, if the "proxies" are kept clear of collision
Detection

We want to identify:

→ Which proxies are involved in active collisions, and
→ Find the closest point (of colliding proxies) to the surface of the offending object

Easy solution (when collision body is rigid)

→ Define level-set of collision body

\( \phi(x) \) s.t. \( |\phi(x)| = \text{distance to surface} \)

and \( \text{sign}(\phi(x)) = \begin{cases} 1 & \text{when outside} \\ -1 & \text{when inside} \end{cases} \)

collision body surface

\[ x_c = x - \frac{\phi(x)}{||\phi(x)||} \]
Response to collisions

For only the active proxies we introduce penalty forces

\[ f(x^p) = -k_c \cdot [x^p \text{ is active}] \cdot (x^p - x_c(x^p)) \]

proxy closest point

and \[ \delta f(x^p; \delta x^p) = -k_c \cdot [x^p \text{ is active}] \cdot \delta x^p \]