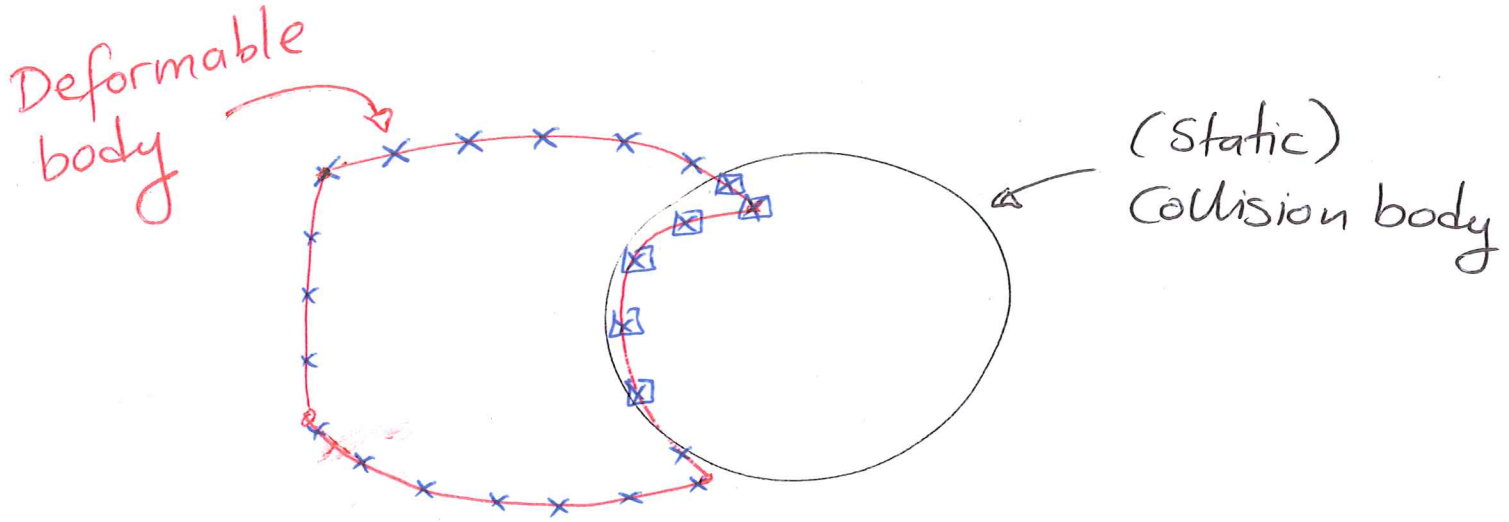
Collision with kinematic (or static) collision objects



× ⟶ 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

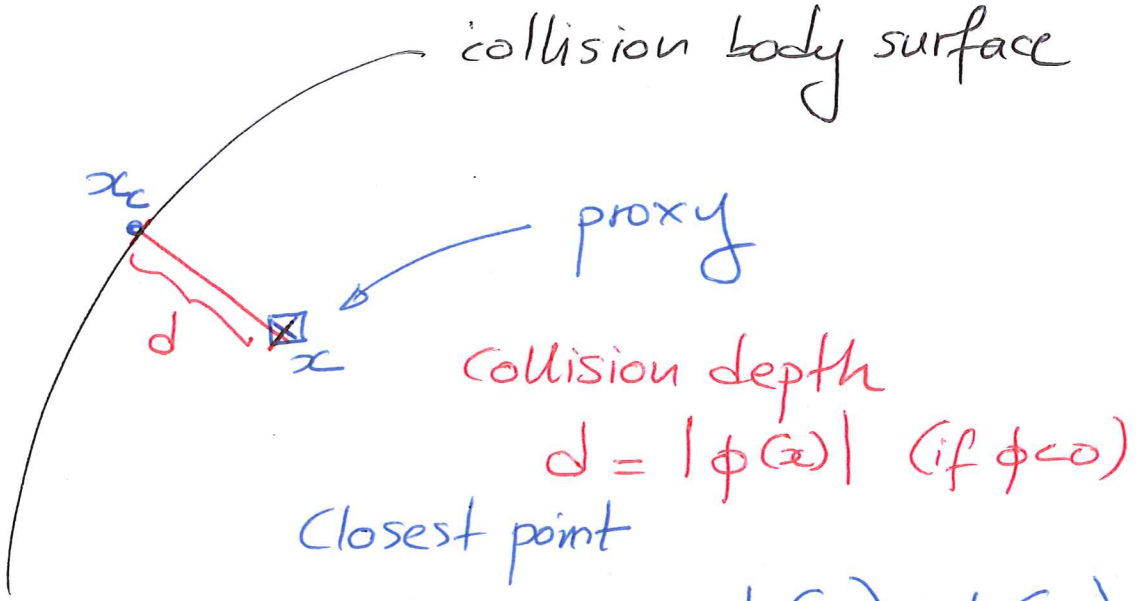
→ Find the closest point (of colliding proxies) to the surface of the offending object

Easy solution (when collision body is rigid)

→ Define level-set of collision body

$\phi(x)$. s.t $|\phi(x)|$ = distance to surface

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



Response to collisions

For only the active proxies we introduce penalty forces

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

(x^p: proxy; $x_c(x_p)$: closest point)

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