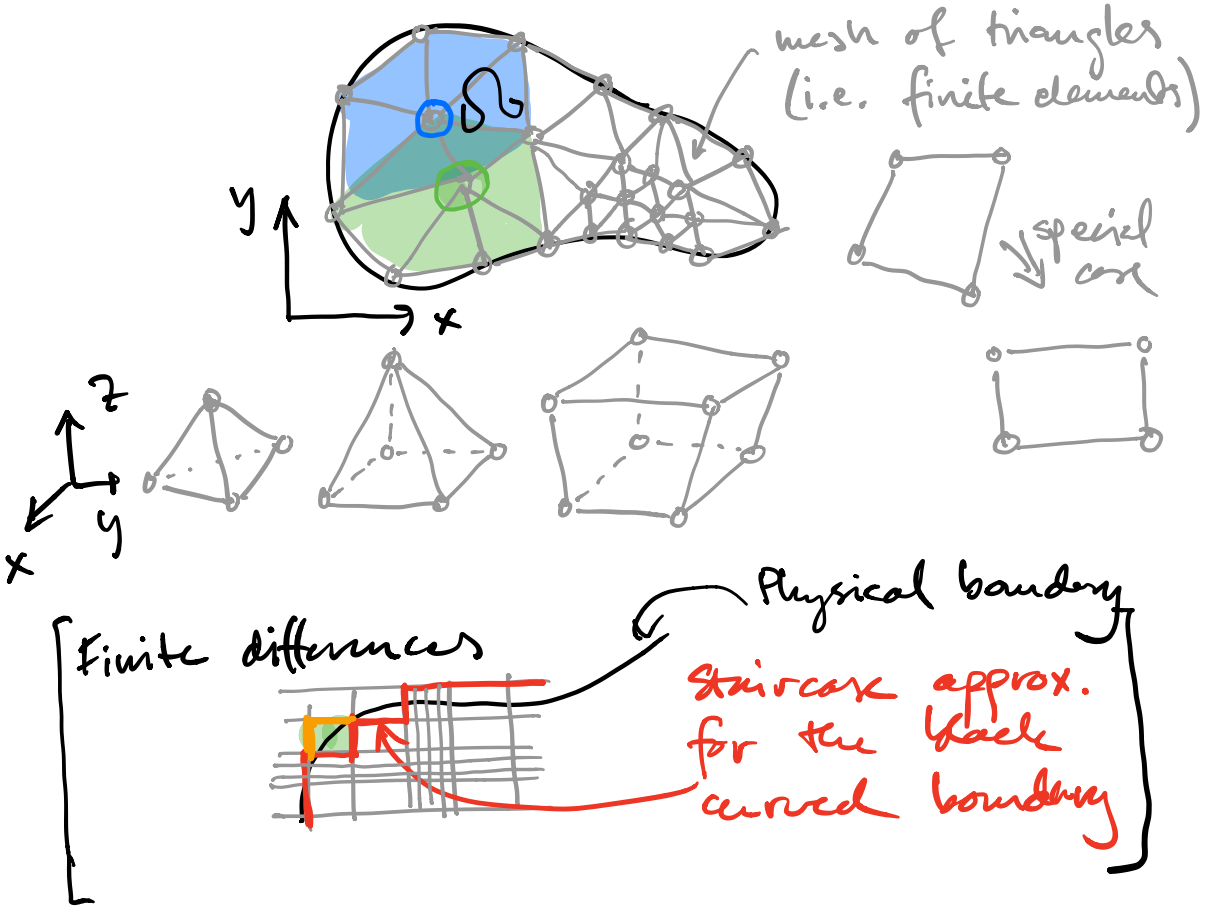
General recipe – finite element method (FEM)

① Discretize (or subdivide) the domain Ω into finite elements



② Approximate the field solution $f(\vec{r}) = \sum_{j=1}^{N} f_j \varphi_j(\vec{r})$, where $\varphi_j(\vec{r})$ are local low-order polynomials.

(3) Form the residual

$r = \mathcal{L}(f) - s$ given

differential eq. $\mathcal{L}(f) = s$

(4) Choose weighting functions $w_i(\vec{r})$

a) Galerkin's method

$\Rightarrow w_i(\vec{r}) = \varphi_i(\vec{r})$ $(i = 1, 2, \ldots, N)$

b) Petrov-Galerkin's method

$\Rightarrow w_i(\vec{r}) \neq \varphi_i(\vec{r})$

(all choices that are not Galerkin's method)

(5) Set the weighted average of the residual to zero

$$\int_{\Omega} w_i \, r \, d\Omega = 0$$

for all $i = 1, 2, \ldots, N$