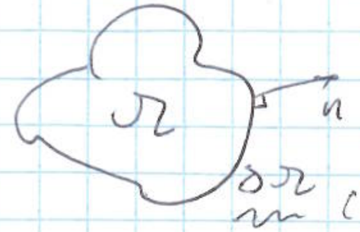
② Neumann boundary conditions

$$\sigma \frac{\partial u}{\partial n} = g$$

(the same as

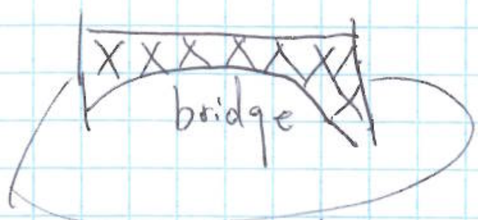
$\sigma \underline{\underline{\nabla u}} \cdot n = g$

remember this is minus current density J



$\Rightarrow$ g is the current going into the boundary.

☆ Boundary conditions are required to solve FEM equations.



Boundary conditions.

$V = IR \Rightarrow$

$\frac{1}{R} V = I$ $\Rightarrow$

Power $= IV = \frac{V^2}{R}$

Power density

$$E \cdot J = \underbrace{\sigma E}_{J} \cdot E$$

$\int_\Omega \sigma E \cdot E \, dx_1 dx_2 dx_3$ Total power.

$$= \int_{\partial\Omega} u \underbrace{\sigma \frac{\partial u}{\partial n}}_{\sigma \cdot J} dS$$

if $\int_\Omega |u|^2 + |\nabla u|^2 \, dx < \infty$ (finite)

we say $u \in \underbrace{H^1}_{\text{H one}}(\Omega)$

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