Strong Form

$$
\begin{aligned}
\frac{1}{\epsilon}\boldsymbol{\sigma} - \nabla u &= 0 \quad && \text{in } \Omega \\
-\nabla \cdot (\boldsymbol{\sigma} - \boldsymbol{\beta} u) &= f \quad && \text{in } \Omega \\
u &= u_0 \quad && \text{in } \partial\Omega
\end{aligned}
$$

Weak Form (Residual Form)

CG

$$
\begin{aligned}
F_u &= \int_\Omega (\boldsymbol{\sigma} - \boldsymbol{\beta} u) \cdot \nabla v - f v \,\mathrm{d}x - \int_{\partial\Omega} (\sigma_n - \beta_n u) v \,\mathrm{d}s && = 0 \quad \forall v \\
F_\sigma &= \int_\Omega \frac{1}{\epsilon}\boldsymbol{\sigma} \cdot \boldsymbol{\tau} + u \nabla \cdot \boldsymbol{\tau} \,\mathrm{d}x - \int_{\partial\Omega} u \boldsymbol{\tau} \cdot n \,\mathrm{d}s && = 0 \quad \forall \boldsymbol{\tau}
\end{aligned}
$$

Now let

$$
u = \sum_i u_i \phi_i \,, \qquad \boldsymbol{\sigma} = \sum_i \boldsymbol{\sigma}_i \boldsymbol{\psi}_i
$$

To calculate jacobians, differentiate with respect to u_i and $\boldsymbol{\sigma}_i$

$$
K_{uu} = \int_\Omega -\boldsymbol{\beta}\phi \cdot \nabla v \,\mathrm{d}x - \int_{\partial\Omega} -\beta_n \phi v \,\mathrm{d}s
$$

$$
K_{u\sigma} = \int_\Omega \boldsymbol{\psi} \cdot \nabla v \,\mathrm{d}x - \int_{\partial\Omega} \psi_n v \,\mathrm{d}s
$$

$$
K_{\sigma u} = \int_\Omega \phi \nabla \cdot \boldsymbol{\tau} \,\mathrm{d}x - \int_{\partial\Omega} \phi \boldsymbol{\tau} \cdot \mathbf{n} \,\mathrm{d}s
$$

$$
K_{\sigma\sigma} = \int_\Omega \frac{1}{\epsilon}\boldsymbol{\psi} \cdot \tau \,\mathrm{d}x
$$

DPG

$$
\begin{aligned}
F_u &= \int_K (\boldsymbol{\sigma} - \boldsymbol{\beta} u) \cdot \nabla v - f v \,\mathrm{d}x - \int_{\partial K} (\sigma_{\widehat{n - \beta}_n} u) \mathrm{sgn}(n) v \,\mathrm{d}s && = 0 \quad \forall v \\
F_\sigma &= \int_K \frac{1}{\epsilon}\boldsymbol{\sigma} \cdot \boldsymbol{\tau} + u \nabla \cdot \boldsymbol{\tau} \,\mathrm{d}x - \int_{\partial K} \hat{u} \boldsymbol{\tau} \cdot n \,\mathrm{d}s && = 0 \quad \forall \boldsymbol{\tau}
\end{aligned}
$$