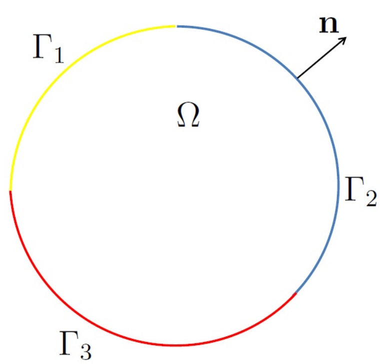
Boundary-value problem for the Poisson equation:

$$-\nabla \cdot (a\nabla u) = f, \quad x \in \Omega \tag{1}$$

$$u|_{\Gamma_1} = g, \qquad \frac{\partial u}{\partial n}\Big|_{\Gamma_2} = 0, \qquad a\frac{\partial u}{\partial n} + b(u - u_b)\Big|_{\Gamma_3} = 0. \tag{2}$$



Reducing to the weak form:

$$u \in H^1(\Omega), \qquad v \in H_0^1(\Omega) := \{v \in H^1(\Omega),\ \ v|_{\Gamma_1} = 0\},$$

$$-\int\limits_{\Omega} \nabla \cdot (a\nabla u) v dx = \int\limits_{\Omega} f v dx,$$

$$\int\limits_{\Omega} a\nabla u \nabla v dx - \int\limits_{\Gamma_1} a\frac{\partial u}{\partial n} v d\Gamma - \int\limits_{\Gamma_2} a\frac{\partial u}{\partial n} v d\Gamma - \int\limits_{\Gamma_3} a\frac{\partial u}{\partial n} v d\Gamma = \int\limits_{\Omega} f v dx,$$

$$\int\limits_{\Omega} a\nabla u \nabla v dx + \int\limits_{\Gamma_3} b(u - u_b) v d\Gamma = \int\limits_{\Omega} f v dx,$$

Weak form:

$$(a\nabla u, \nabla v) + \int\limits_{\Gamma_3} b(u - u_b) v d\Gamma = (f, v), \quad u|_{\Gamma_1} = g.$$