2D Steady-State Problems (Galerkin method)

PDEs:

$$
\begin{aligned}
\frac{\partial}{\partial x}A_1(x,y,U1,U1_x,U1_y,...,UN,UN_x,UN_y) & \\
+\frac{\partial}{\partial y}B_1(x,y,U1,U1_x,U1_y,...,UN,UN_x,UN_y) &= \\
F_1(x,y,U1,U1_x,U1_y,...,UN,UN_x,UN_y) & \\
. &= \\
. &= \\
\frac{\partial}{\partial x}A_N(x,y,U1,U1_x,U1_y,...,UN,UN_x,UN_y) & \\
+\frac{\partial}{\partial y}B_N(x,y,U1,U1_x,U1_y,...,UN,UN_x,UN_y) &= \\
F_N(x,y,U1,U1_x,U1_y,...,UN,UN_x,UN_y) &
\end{aligned}
$$

Boundary conditions:

$$
\begin{aligned}
U1 &= FB_1(x,y) \\
. &= . \\
. &= . \\
UN &= FB_N(x,y)
\end{aligned}
$$

or

$$
\begin{aligned}
A_1N_x + B_1N_y &= GB_1(x,y,U1,U1_x,U1_y,...,UN,UN_x,UN_y) \\
. &= . \\
. &= . \\
A_NN_x + B_NN_y &= GB_N(x,y,U1,U1_x,U1_y,...,UN,UN_x,UN_y)
\end{aligned}
$$

where (N_x, N_y) = unit outward normal vector.