

2D Eigenvalue Problems (Collocation method)

PDEs (must be linear):

$$\begin{aligned} F_1(x, y, U_1, U_{1x}, U_{1y}, U_{1xx}, U_{1yy}, U_{1xy}, U_2, \dots) &= \\ \lambda_{\rho_{11}}(x, y)U_1 + \dots + \lambda_{\rho_{1N}}(x, y)U_N & \\ & \cdot = \\ & \cdot = \\ F_N(x, y, U_1, U_{1x}, U_{1y}, U_{1xx}, U_{1yy}, U_{1xy}, U_2, \dots) &= \\ \lambda_{\rho_{N1}}(x, y)U_1 + \dots + \lambda_{\rho_{NN}}(x, y)U_N & \end{aligned}$$

Boundary conditions:

$$\begin{aligned} G_1(x, y, U_1, U_{1x}, U_{1y}, \dots, U_N, U_{Nx}, U_{Ny}) &= 0 \\ & \cdot = \cdot \\ & \cdot = \cdot \\ G_N(x, y, U_1, U_{1x}, U_{1y}, \dots, U_N, U_{Nx}, U_{Ny}) &= 0 \end{aligned}$$

(Periodic and “no” boundary conditions are also permitted.)