

# 1D Eigenvalue Problems (Galerkin method)

PDEs (must be linear):

$$\begin{aligned} \frac{\partial A_1}{\partial x}(x, U_1, U_{1x}, \dots, U_N, U_{Nx}) &= F_1(x, U_1, U_{1x}, \dots, U_N, U_{Nx}) \\ &\quad + \lambda \rho_{11}(x)U_1 + \dots + \lambda \rho_{1N}(x)U_N \\ &= \\ &= \\ \frac{\partial A_N}{\partial x}(x, U_1, U_{1x}, \dots, U_N, U_{Nx}) &= F_N(x, U_1, U_{1x}, \dots, U_N, U_{Nx}) \\ &\quad + \lambda \rho_{N1}(x)U_1 + \dots + \lambda \rho_{NN}(x)U_N \end{aligned}$$

Boundary conditions (at endpoints):

$$\begin{aligned} U_1 &= FB_1 \\ &= \\ &= \\ U_N &= FB_N \end{aligned}$$

or

$$\begin{aligned} \pm A_1 &= GB_1(U_1, U_{1x}, \dots, U_N, U_{Nx}) \\ &= \\ &= \\ \pm A_N &= GB_N(U_1, U_{1x}, \dots, U_N, U_{Nx}) \end{aligned}$$