

1D Time-Dependent Problems (Collocation method)

PDEs:

$$\begin{aligned} C_{11} \frac{\partial U_1}{\partial t} + \dots + C_{1N} \frac{\partial U_N}{\partial t} &= F_1(x, t, U_1, U_{1x}, U_{1xx}, \dots, U_N, U_{Nx}, U_{Nxx}) \\ &= \\ &= \\ C_{N1} \frac{\partial U_1}{\partial t} + \dots + C_{NN} \frac{\partial U_N}{\partial t} &= F_N(x, t, U_1, U_{1x}, U_{1xx}, \dots, U_N, U_{Nx}, U_{Nxx}) \end{aligned}$$

where the C_{ij} are functions of (x, t, U_1, \dots, U_N) .

Boundary conditions (at endpoints):

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

(periodic and "no" boundary conditions are also permitted)

Initial conditions:

$$\begin{aligned} U_1(x, t_0) &= U_{10}(x) \\ &= \\ &= \\ U_N(x, t_0) &= U_{N0}(x) \end{aligned}$$