

2D Time-Dependent Problems (Collocation method)

PDEs:

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

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

Boundary conditions:

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

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

Initial conditions:

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