2D Time-Dependent Problems (Collocation method)

PDEs:

$$\begin{aligned}
C_{11}(x,y,t,U1,...,UN)\frac{\partial U1}{\partial t} + \cdots + C_{1N}(x,y,t,U1,...,UN)\frac{\partial UN}{\partial t} &= \\
F_1(x,y,t,U1,U1_x,U1_y,U1_{xx},U1_{yy},U1_{xy},U2,...) & \\
. &= \\
. &= \\
C_{N1}(x,y,t,U1,...,UN)\frac{\partial U1}{\partial t} + \cdots + C_{NN}(x,y,t,U1,...,UN)\frac{\partial UN}{\partial t} &= \\
F_N(x,y,t,U1,U1_x,U1_y,U1_{xx},U1_{yy},U1_{xy},U2,...) &
\end{aligned}$$

Boundary conditions:

$$\begin{aligned}
G_1(x,y,t,U1,U1_x,U1_y,...,UN,UN_x,UN_y) &= 0 \\
. &= . \\
. &= . \\
G_N(x,y,t,U1,U1_x,U1_y,...,UN,UN_x,UN_y) &= 0
\end{aligned}$$

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

Initial conditions:

$$\begin{aligned}
U1(x,y,t_0) &= U1_0(x,y) \\
. &= . \\
. &= . \\
UN(x,y,t_0) &= UN_0(x,y)
\end{aligned}$$