

ADDENDUM EXERCISE 5

The CFL-condition for the 2-dimensional heat equation was used to choose the timestep size:

$$\Delta t \leq \frac{1}{2(1 - 2\theta)} \left[\frac{(\Delta x)^2 (\Delta y)^2}{(\Delta x)^2 + (\Delta y)^2} \right]$$

- If the shape function is changed to a nonlinear function timestep size has to be increased as the cell size decreases for Δy

NOTES: OBSERVATIONS (SEE VIDEOS)

The dimension of the domain was chosen as: $\dim X = \dim Y = 10$

with a *timestep size* = 0.0125

- *Explicit Euler & Linear shape function*: Instabilities in the beginning, stabilizes as time evolves
- *Explicit Euler & quadratic shape function*: numerical instable
- *Crank-Nicolson*: stable
- *RK4-scheme*: shows numerical artefacts
- *Explicit Euler* is more robust against numerical instabilities if just Dirichlet boundary conditions are prescribed