

To get the best of FTCS & Crank-Nicholson

$$\frac{d^2T}{dx^2} = \gamma \left[\frac{T_{i+1,j+1} - 2T_{i+1,j} + T_{i+1,j-1}}{\Delta x^2} \right] +$$
$$(1-\gamma) \left[\frac{T_{i,j+1} - 2T_{i,j} + T_{i,j-1}}{\Delta x^2} \right]$$

implicit
explicit

γ = tuning parameter

$\gamma = 0$ explicit : FTCS

$\gamma = 1$ implicit : Crank-Nicholson

$\gamma = \frac{1}{2}$ Crank-Nicholson method

Crank Nicholson $\gamma = \frac{1}{2}$

$$-F \left[\underset{?}{T_{i+1, j+1}} + \underset{?}{T_{i+1, j-1}} \right] + 2(1+F) \underset{?}{T_{i+1, j}} =$$

$$F \left[\underset{\checkmark}{T_{i, j+1}} + \underset{\checkmark}{T_{i, j-1}} \right] + 2(1-F) \underset{\checkmark}{T_{i, j}}$$

$$F = \frac{\alpha \Delta t}{\Delta x^2}$$