1st reminder of iterative method Gauss-Seidel to solve $Ax=b$

One iteration, i.e. we have $x^{(k)}$ and get $x^{(k+1)}$

for $i=1:n$

$$x_i^{(k+1)} = \frac{b_i - \sum_{j<i} a_{ij} x_j^{(k+1)} - \sum_{j>i} a_{ij} x_j^{(k)}}{a_{ii}}$$

end

we do this several iterations till $\|x^{(k+1)} - x^{(k)}\|$ is very small.

Gauss-Seidel for the Crank Nicolson system (*) (European)

$$b_1 = \alpha_1 (f_0^n + f_0^{n-1}) + (1+\beta_1) f_1^n + \gamma_1 f_2^n$$

$$b_i = \alpha_i f_{i-1}^n + (1+\beta_i) f_i^n + \gamma_i f_{i+1}^n \qquad 2 \le i \le M-2$$

$$b_{M-1} = \alpha_{M-1} f_{M-2}^n + (1+\beta_{M-1}) f_{M-1}^n + \gamma_{M-1} (f_M^n + f_M^{n-1})$$

recall α_i, β_i & γ_i

$$a_{i\,i-1} = -\alpha_i \qquad 2 \le i \le M-1$$

$$a_{ii} = (1-\beta_i) \qquad 1 \le i \le M$$

$$a_{i\,i+1} = -\gamma_i \qquad 1 \le i \le M-2$$

$$a_{ij} = 0 \quad \text{if} \quad |j-i| \ge 2$$