can be written as

$$b_j^{n+1} = b_j^n - C_1\left[(b_j^n)^3 - (b_{j-1}^n)^3 + (b_j^{n+1})^3 - (b_{j-1}^{n+1})^3\right]$$
$$+ C_2\left[(b_{j+1}^n + b_{j-1}^n)^3(b_{j+1}^n - b_j^n) - (b_j^n + b_{j-1}^n)^3(b_j^n - b_{j-1}^n)\right]$$
$$+ C_2\left[(b_{j+1}^{n+1} - b_{j-1}^{n+1})^3(b_{j+1}^{n+1} - b_j^{n+1}) - (b_j^{n+1} + b_{j-1}^{n+1})^3(b_j^{n+1} - b_{j-1}^{n+1})\right]$$

where $C_1 = \alpha\frac{\Delta t}{2\Delta z}$ and $C_2 = \beta\frac{\Delta t}{16(\Delta z)^2}$

$$J_{ij} = \frac{\partial R_{ij}}{\partial b_{ij}} = \frac{R_{ij,pert} - R_{ij}}{\varepsilon}$$

Solve for $J\delta b = -R$

$$\Rightarrow b^{n+1} = b^n + \delta b$$

- Crank-nicholson takes longer to compute given more calculations at each step of the calculation.
- Slightly more accurate solution achieved.