IMPLICIT FINITE DIFFERENCE APPROXIMATION OF THE 2D PRESSURE EQUATION

When we discretize the following:

$$\beta \left(\frac{\partial P}{\partial t}\right) = \frac{\partial}{\partial x}\left[\hat{k}_x \left(\frac{\partial P}{\partial x}\right)\right] + \frac{\partial}{\partial y}\left[\hat{k}_y \left(\frac{\partial P}{\partial y}\right)\right]$$

We get an implicit finite difference scheme.

If we then rearrange and take all the unknown terms to the LHS & the known terms to the RHS, we get an equation that has a set of <u>five</u> non-zero terms per grid block (these are the coefficients).

So in this 2D case it is known as a pentadiagonal matrix.

The set of linear equations are as follows:

$$\left(a_{i-1} \times P_{i-1,j}^{n+1}\right) + \left(a_{i+1,j} \times P_{i+1,j}^{n+1}\right) + \left(a_{i,j} \times P_{i,j}^{n+1}\right) + \left(a_{i,j-1} \times P_{i,j-1}^{n+1}\right)$$

$$+ \left(a_{i,j+1} \times P_{i,j+1}^{n+1}\right) = b_{i,j}$$