Symbolic generating of system equations for 2D regular grid for solving the Laplace equation using finite difference method

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$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial x^2} = f(x, y)$$

When solving the above equation using finite difference method on square, in order to make it easy to see the internal structure of the A matrix using the standard 5 points Laplacian scheme, the following is a small function which generates the symbolic format of these equations for a given N, the number of grid points on one edge. At the end of this note, the system equations are generated for $N = 4, 5, 6, 7, 8$. One can see the form of the A matrix with the dominant diagonal.

1. HTML

2. PDF

3. Mathematica notebook