FINITE ELEMENT METHODS IN CIVIL ENGINEERING

HOMEWORK ASSESSMENT – III

IMPLEMENTATION OF FEM ON TWO-DIMENSIONAL PROBLEMS

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Q2) PLANE STRESS ANALYSIS OF THIN TWO-DIMENSIONAL PLATE:

MATLAB OUTPUT

Nodal Displacements (mm)

NODE NO.	X-DISP	Y-DISP
1	0.000e+00	0.000e+00
2	0.000e+00	0.000e+00
3	5.465e-03	-3.053e-03
4	1.168e-02	3.298e-03
5	1.810e-02	-3.085e-03
6	1.821e-02	3.281e-03

Fig.1 In-plane Nodal Displacements in (mm)

Q3)a PLANE AXIALLY LOADED PLATE WITH SQUARE HOLE IN THE MIDDLE:

MATLAB OUTPUT

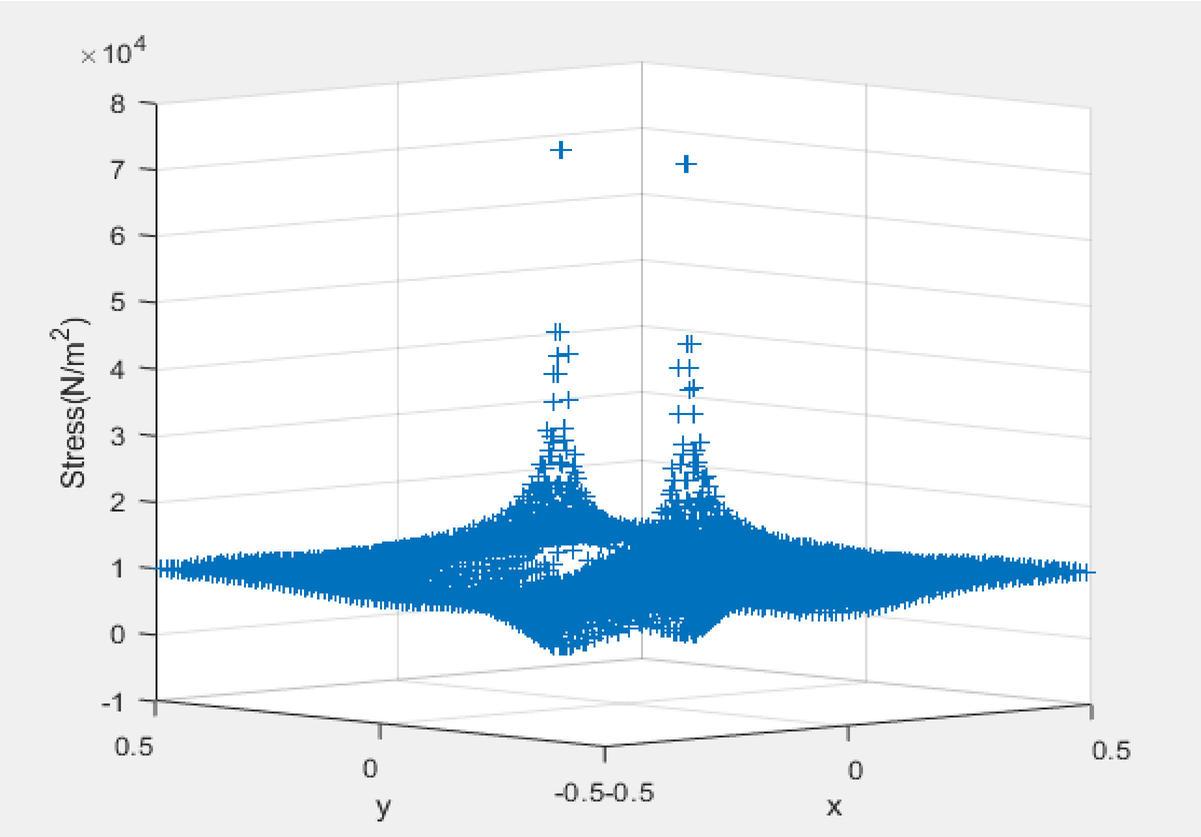

Fig.2) Axial stress distribution for plate with square hole (N/m^2)

In this case we observe that the maximum stress occurs at the top and bottom corner edges of the hole due the easy tendency of that part to pave way for the appearance of cracks. Compressive stresses occur at the left and right corner edges of the hole respectively which is once again self explanatory. With increase in the lengths along the direction of the applied stress, the transverse direction shortens due to poisson's effect and the left and right corner points near the hole experience compression.

From the FE analysis, the maximum tensile stress obtained = 7.22*10^4 N/m^2

Stress Concentration Factor = 0.072

Q3)b PLANE AXIALLY LOADED PLATE WITH CIRCULAR HOLE IN THE MIDDLE:

MATLAB OUTPUT:

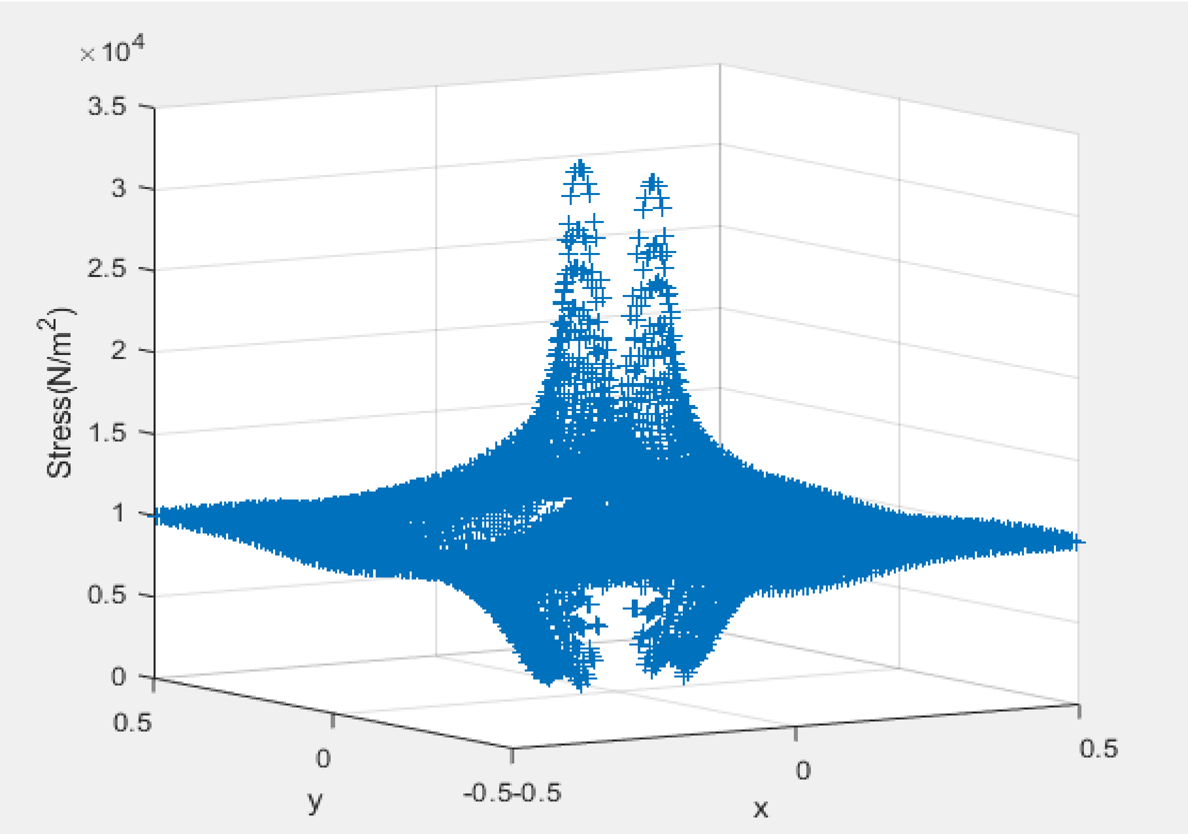

Fig.2) Axial stress distribution for plate with circular hole (N/m^2)

From the FE analysis, the maximum tensile stress obtained = 3.17*10^4 N/m^2

Stress Concentration Factor = 0.0317

Hence ratio of both the stress concentration factors:

$$\frac{SCF(Square\ Hole)}{SCF(Circular\ Hole)} = \frac{0.072}{0.0317} = 2.27$$