Description :

A simply Supported square plate with distributed load (q).

Reference :

S.Timoshenko , S . Woinowsky , Theory of Plates and Shells , pg:381, Article : 30 .

Material and Geometric data :

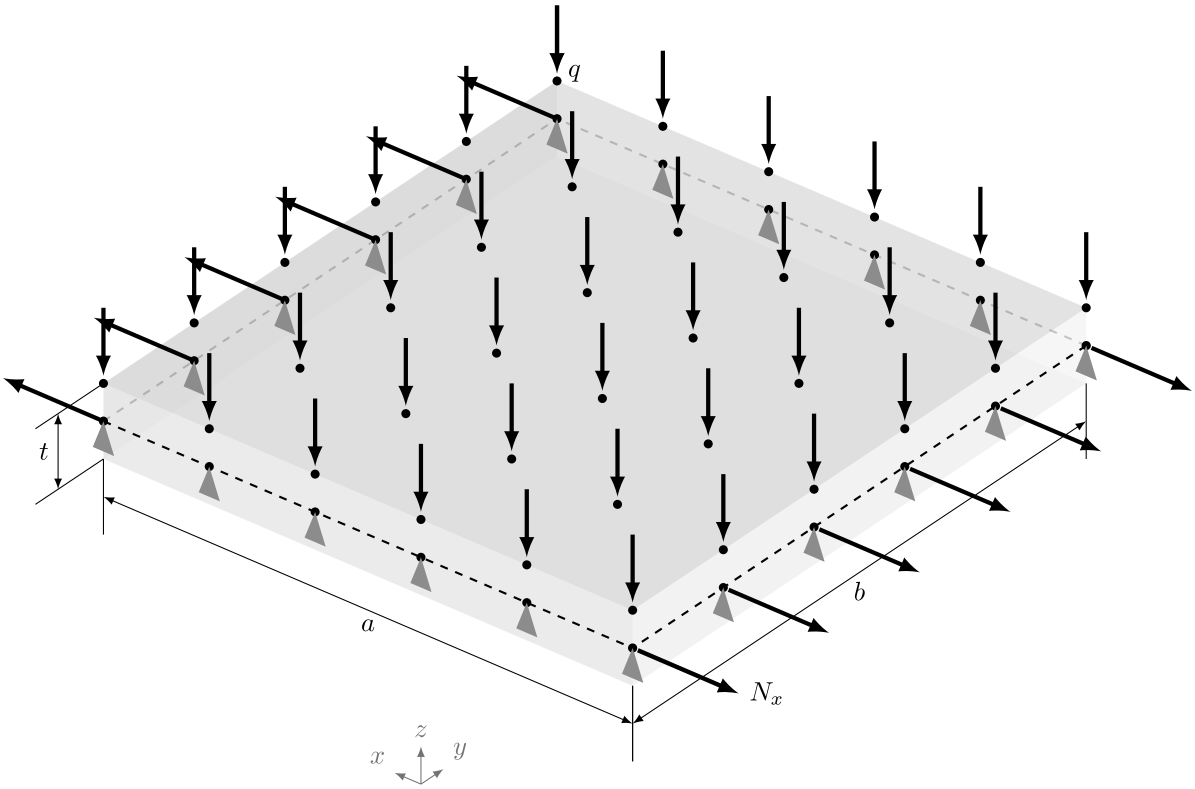

Figure 1: TIM381

Table 1: Input Data

Material Property		Geometric Data		Loading Data	
Young's Modulus (E)	2E11 pa	Length (a)	10 m	Axial Tension(N_x)	2E7 N/m
Poission's Ratio (ν)	0.3	Breath (b)	10 m	Distributed Load (q)	1000 N/m^2
		Thickness(t)	0.1 m		

Mesh and boundary condition :

Analytically solution :

The w_{max}which is the w displacement at the middle of the plate is given by

$$w_{max} = \alpha \frac{qb^4}{Et^3} \tag{1}$$

Where α can be taken from the graph given in the figure : **??**. For this problem alpha is taken as $\alpha \approx 0.0113$.

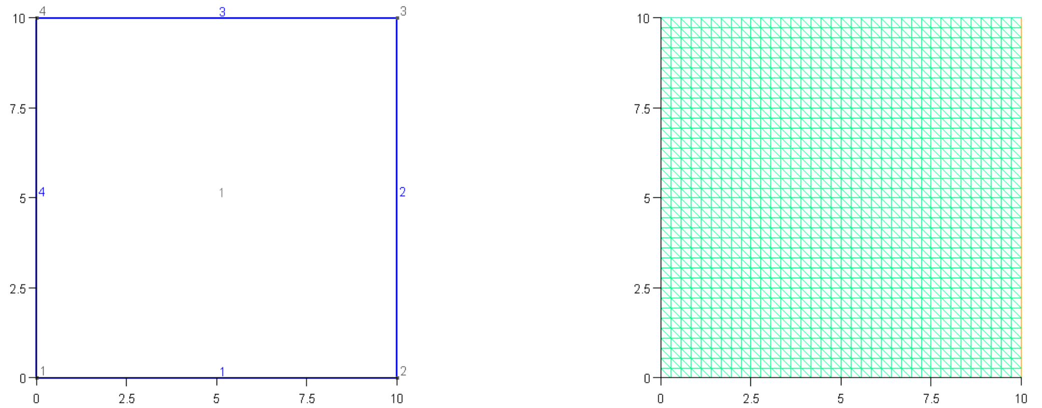

Figure 2: Geomentry and Mesh of TIM381

Table 2: FEM and Boundary condition data

Direchlet Boundary				Neumann Boundary			
Geo -Entity	w	θ_x	θ_y	Geo -Entity	F_z	M_x	M_y
line {1,2,3,4}	Fixed	Free	Free	Area {1}	1000 N/m^2		
				Geo -Entity	Fx		
				line{1,3}	2E7 N/m		

The parameter γ is given by

$$\gamma = \frac{N_x b^2}{4\pi^2 D} \tag{2}$$

The analytically solution of the problem is calculated as $w_{max} = 0.000565m$

Result and error analysis :

The maximum displacement of the domain is our solution . w displacement at middle is $0.000566m$.

So the Error percentage is 0.17%.

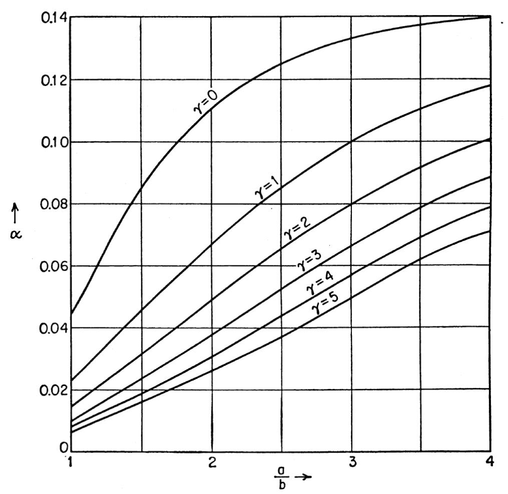

Figure 3: Graph to find α .

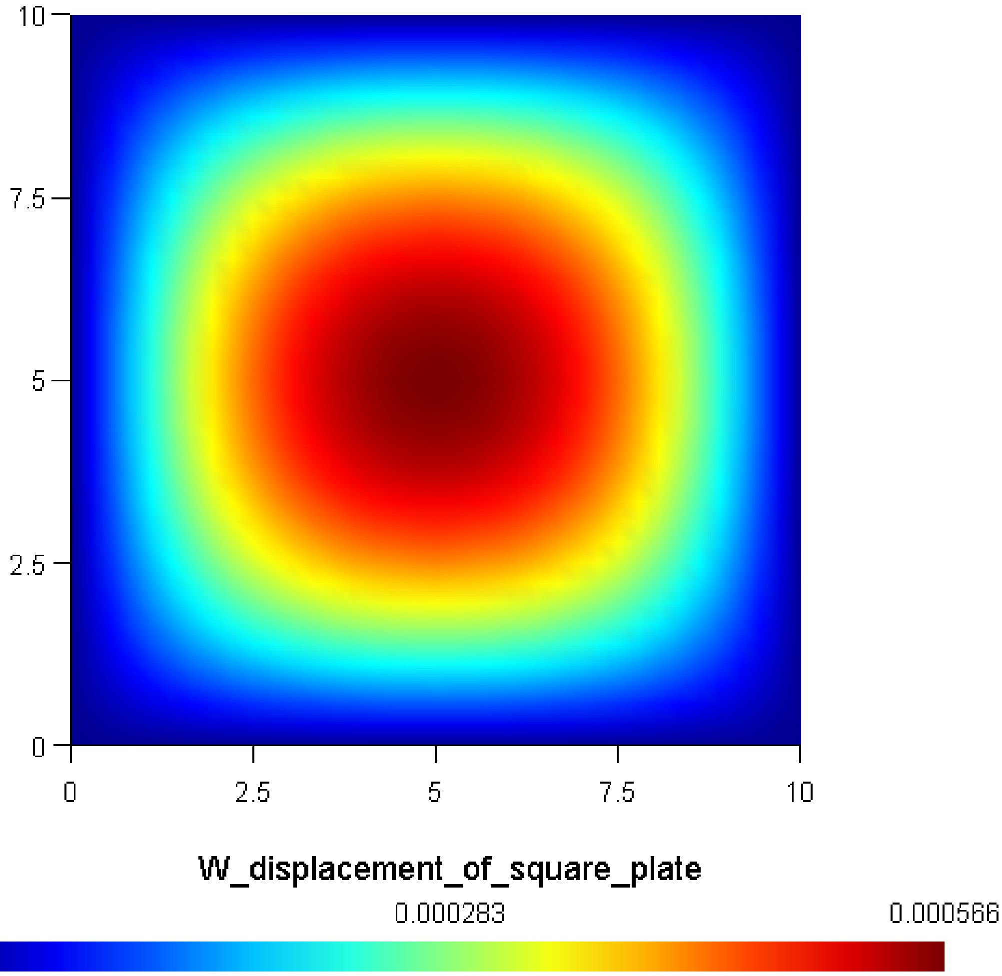

Figure 4: FEM solution plot