Example 33: Verifying displacements of a plate with a hole

1 Description of the problem

To verify the mathematical model of *ELPLA* for computing plane stresses, results of a plate with a hole introduced by *Thakkar* (2017) are compared with those obtained by *ELPLA*. A rectangular plate of dimensions 1000 [mm] × 600 [mm] and thickness 1 [mm], has a central circular hole of a diameter 200 [mm] as shown in Figure 92. The plate is subjected to a tensile stress σ_o= 500 [N/mm^2] its sides.

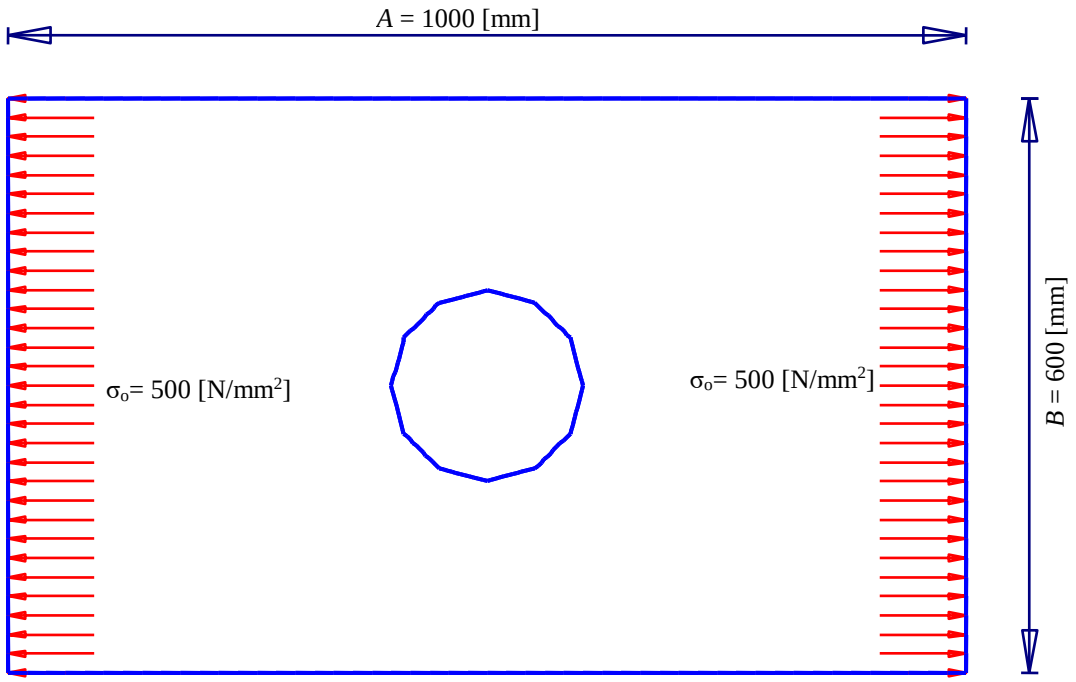

Figure 92 Plate with a hole

2 Plate dimensions

The plate has the following dimensions:

Plate length	A = 1000	[mm]
Plate width	B = 600	[mm]
Plate thickness	t = 1	[mm]

3 Plate material

Material of the plate has the following parameters:

Young's modulus	E_b	= 2 × 10^5	[N/mm^2]
Poisson's ratio	ν_b	= 0.3	[-]
Unit weight	γ_b	= 0	[N/mm^3]

The self-weight of the plate is ignored.

4 Analysis

Figure 93 shows the finite element mesh of the plate, which consists of 5700 elements. Boundary conditions are used by *Thakkar* (2017) to ensure the symmetry conditions as shown in the figure. Tensile stress σ_o= 500 [N/mm^2] on the sides are replaced by point forces on side nodes, each of 10000 [N].

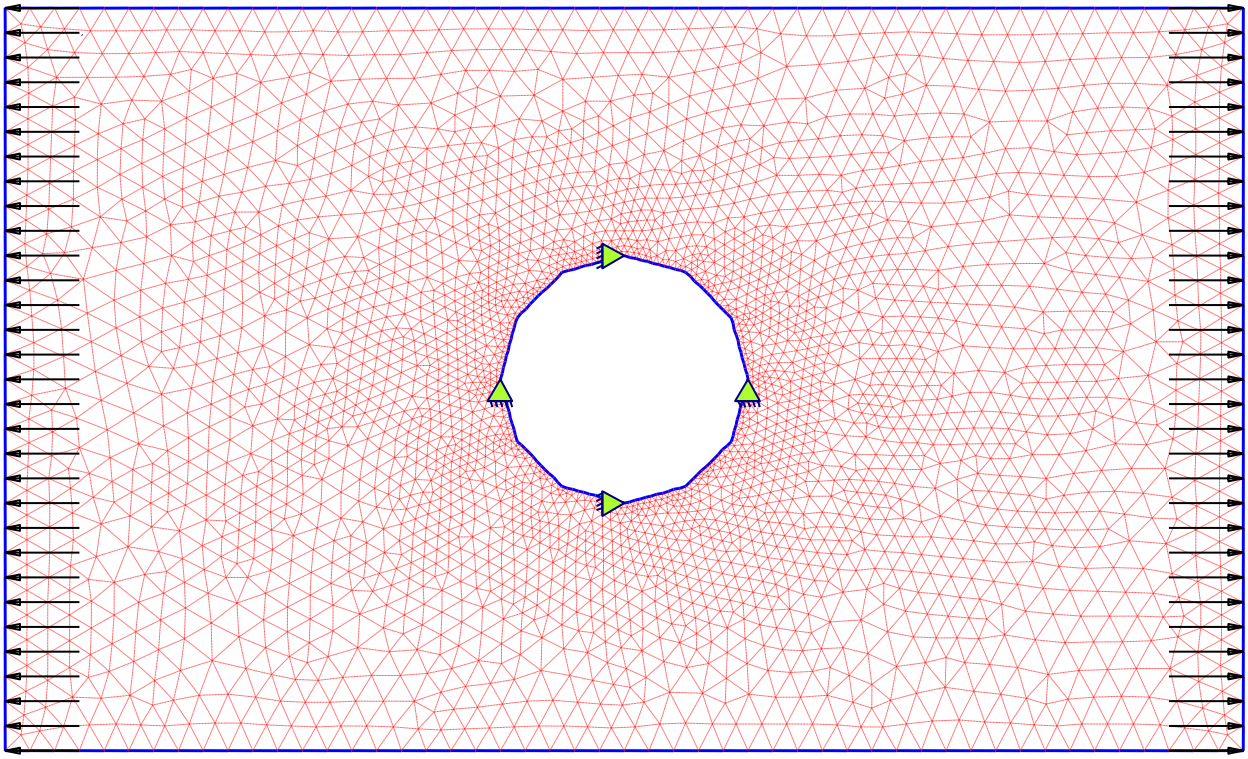

Figure 93 Finite element mesh with loads and boundary conditions

5 Results

Results of *ELPLA* are compared with the that of *Thakkar* (2017) in Table 48. From this table, it can be noticed that results of maximum and minimum displacements obtained by *ELPLA* are the same as those of *Thakkar* (2017).

Table 48 Comparison of displacements obtained by *ELPLA* and *Thakkar* (2017)

Case	Displacements obtained by *Thakkar* (2017)		Displacements obtained by *ELPLA*	
	u [mm]	*v* [mm]	*u* [mm]	*v* [mm]
Max.	1.597	0.488	1.597	0.488
Min.	-1.597	-0.488	-1.597	-0.488