

Numerical experiment 1

Material parameters:

Young's modulus $E = 0.52^{10}[\text{Pa}]$ and Poisson's ratio $\nu = 0,18$.

Boundary conditions:

Prescribed displacement $(-2, 5 \times 10^{-2}, 0) [\text{m}]$ on 3-4.

Pressure $0,5 \times 10^7 [\text{Pa}]$ on 1-4.

Bilateral contact boundary: 1-2 and 2-3.

Unilateral contact boundary: 5-6 and 7-8.

Discretization statistics:

12 subdomains, 5501 nodes, 9676 elements, 10428 unknowns,

89 unilateral contact conditions, 466 interface elements.

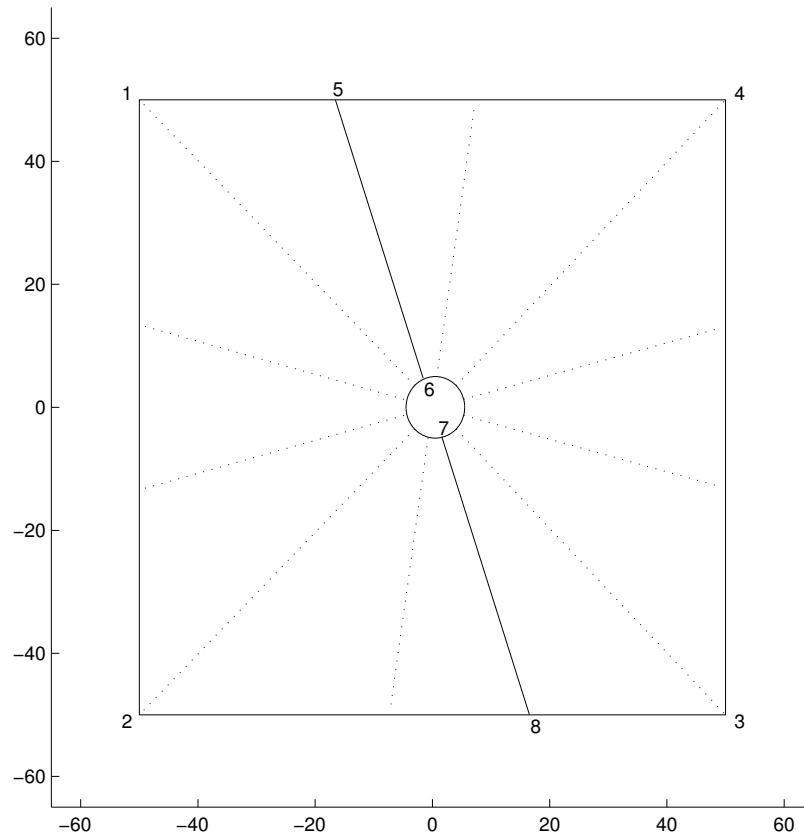


Figure 1: Problem 1 - geometry

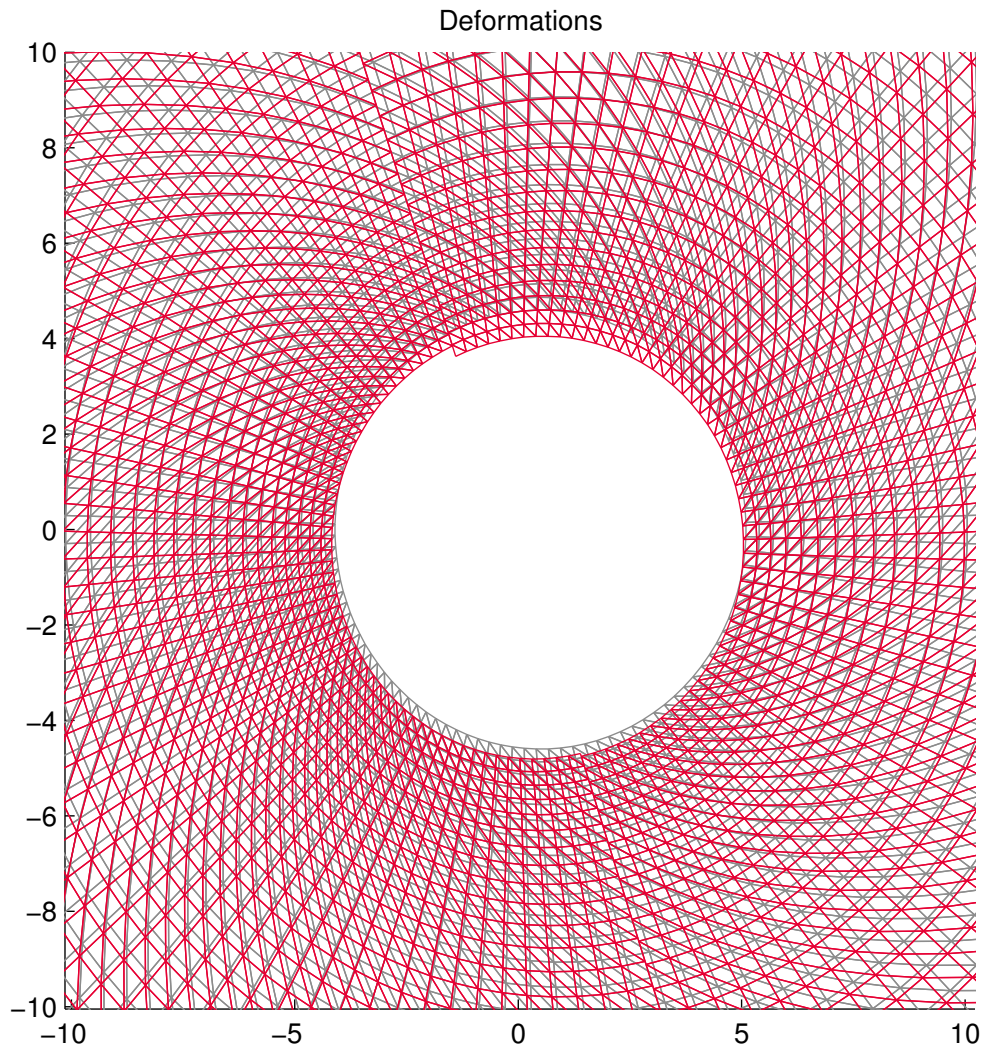


Figure 2: Problem 1a) - A detail of deformations (enlarge factor=10)

Boundary conditions:

Prescribed displacement $(-2, 5 \times 10^{-2}, 0)$ [m] on 3-4.

Pressure $0,5 \times 10^7$ [Pa] on 1-4.

Bilateral contact boundary: 1-2 and 2-3.

Unilateral contact boundary: 5-6 and 7-8.

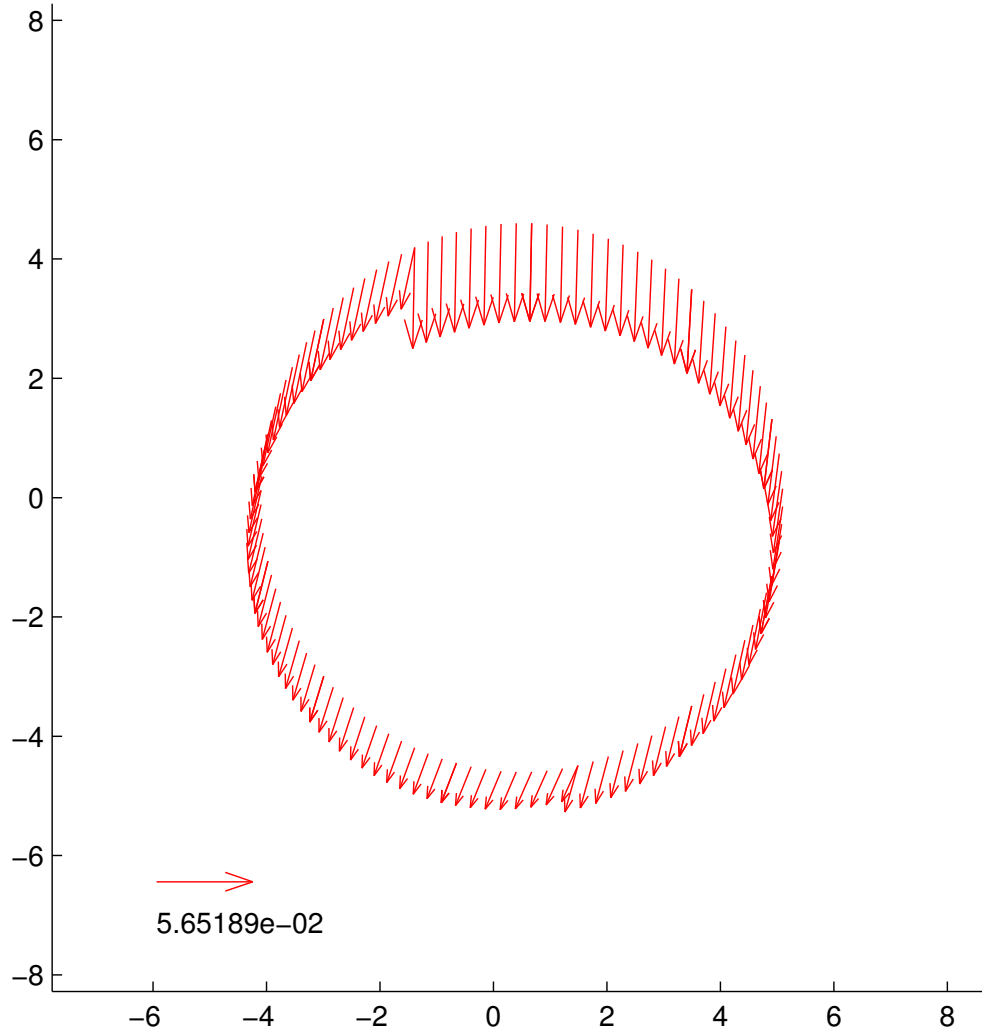


Figure 3: Problem 1 - A detail of deformations

Boundary conditions:

Prescribed displacement $(-2, 5 \times 10^{-2}, 0)$ [m] on 3-4.

Pressure $0,5 \times 10^7$ [Pa] on 1-4.

Bilateral contact boundary: 1-2 and 2-3.

Unilateral contact boundary: 5-6 and 7-8.

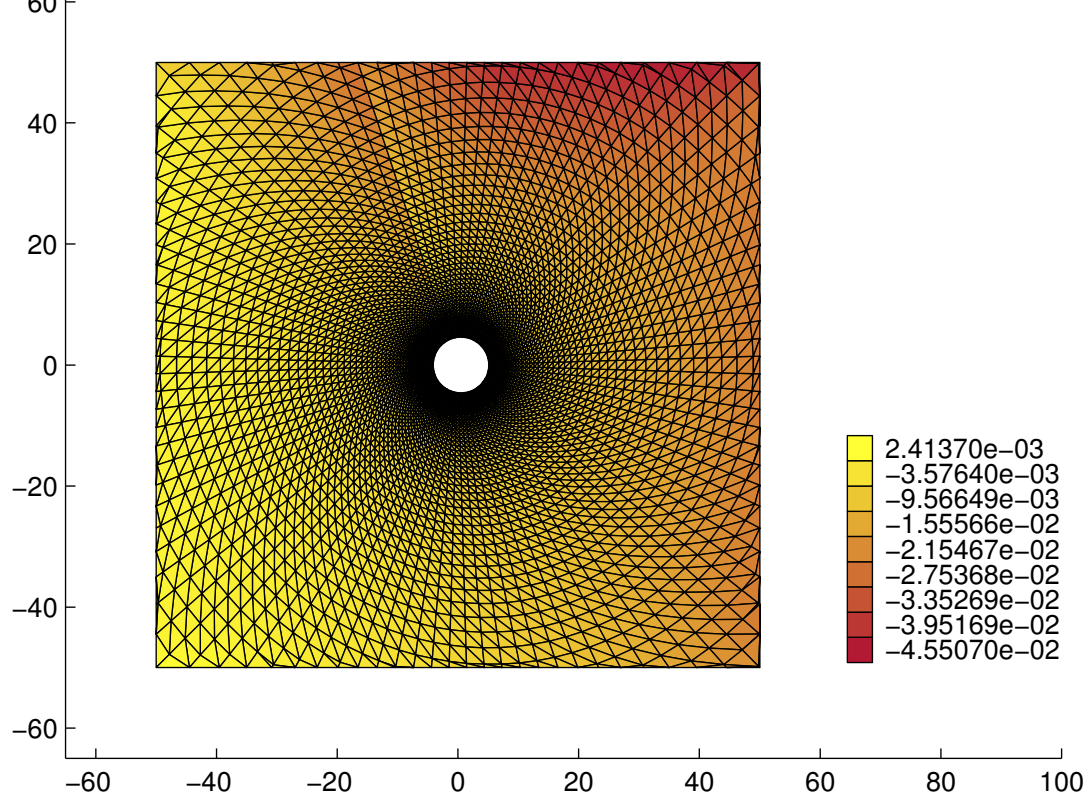


Figure 4: Problem 1 - horizontal component of displacement

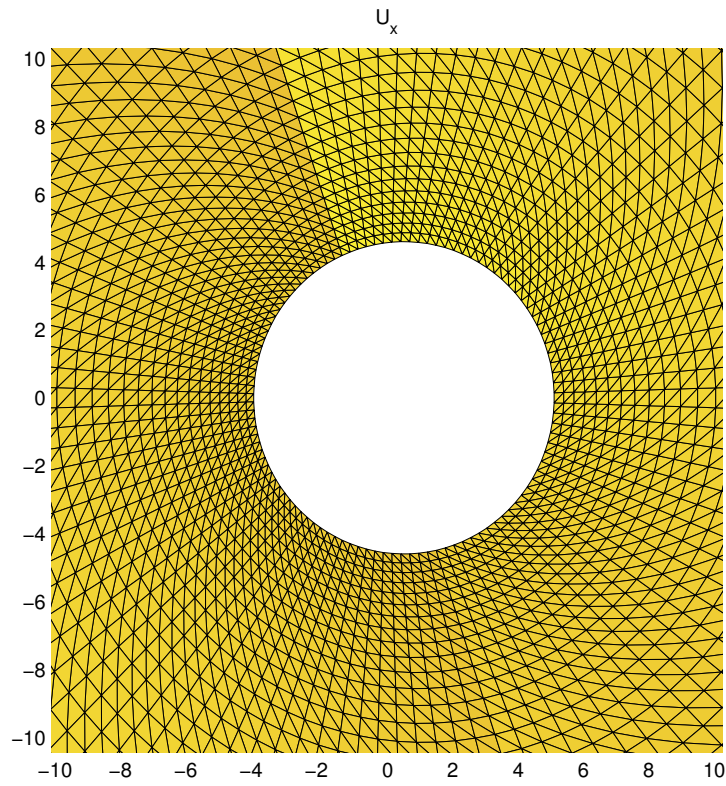


Figure 5: Problem 1 - detail of horizontal component of displacement

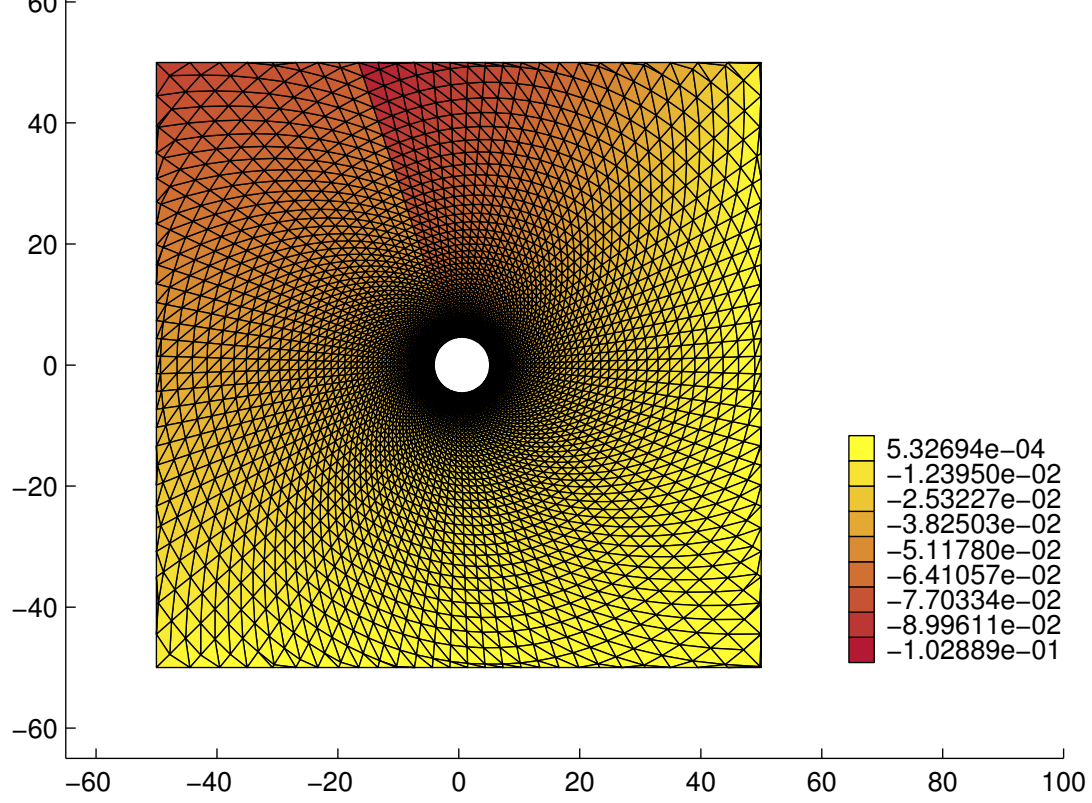


Figure 6: Problem 1 - vertical component of displacement

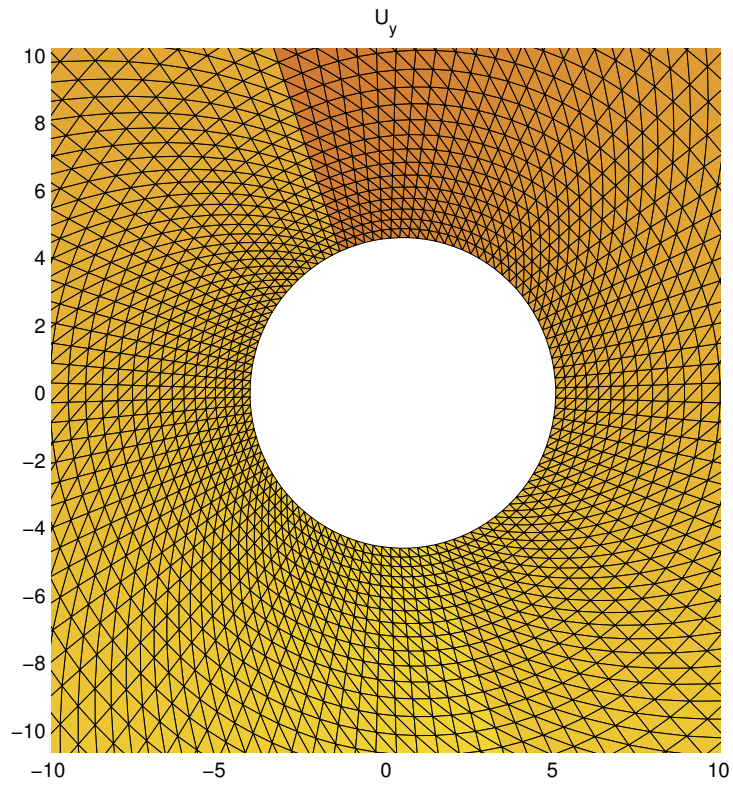


Figure 7: Problem 1 - detail of vertical component of displacement

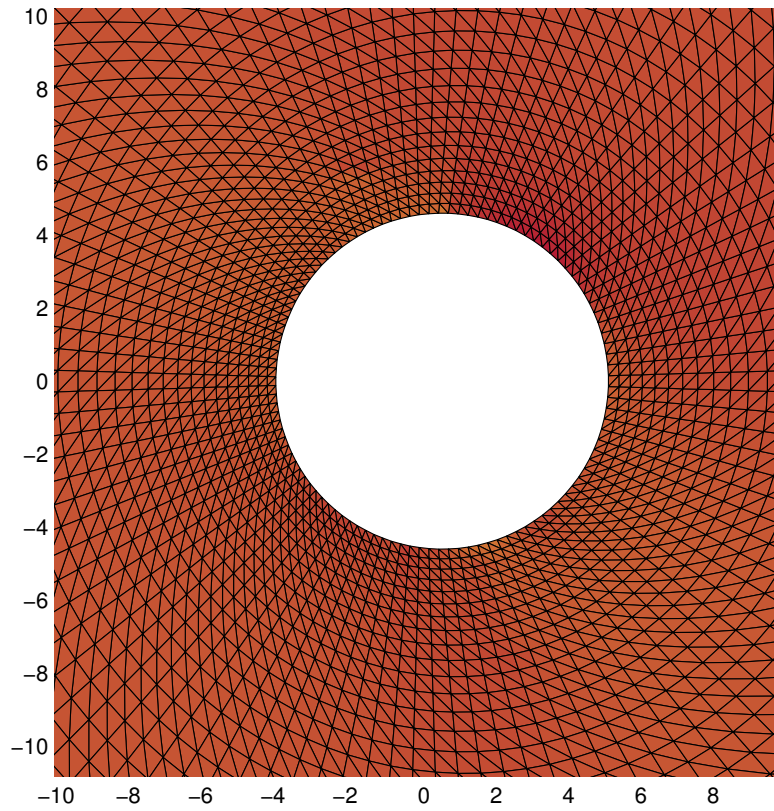
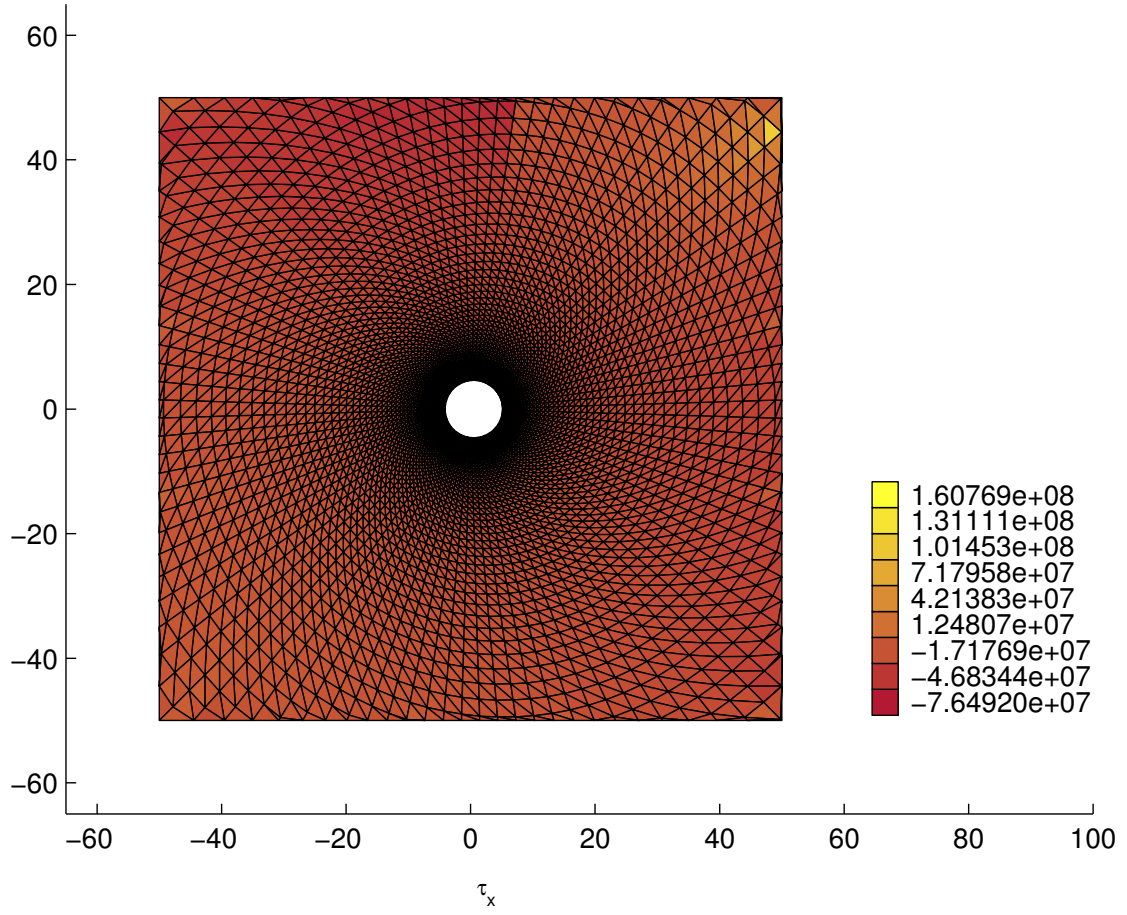


Figure 8: Problem 1 - A detail of stresses τ_x

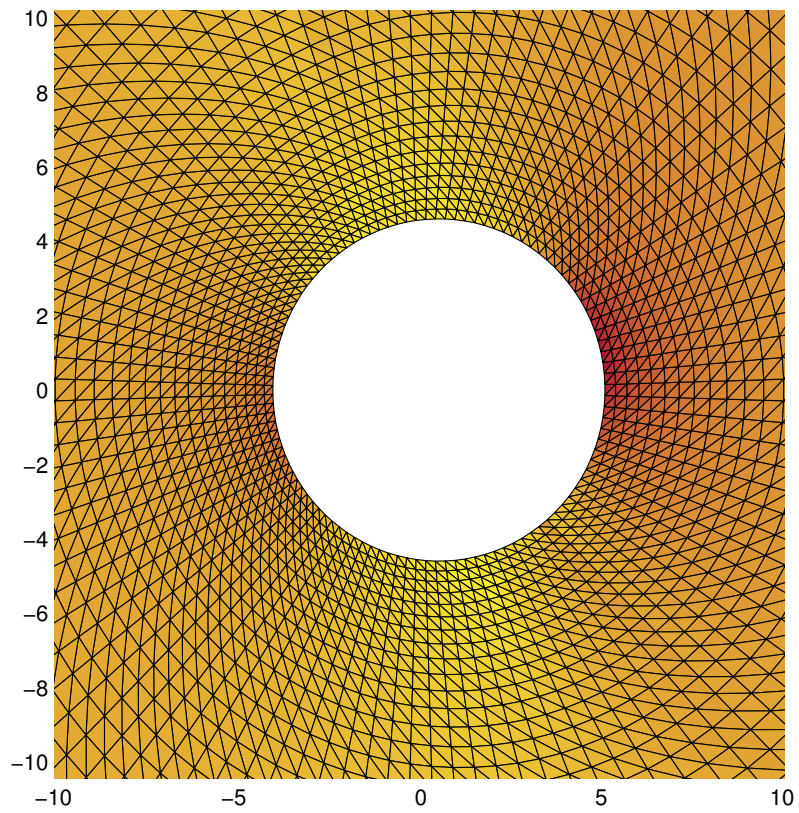
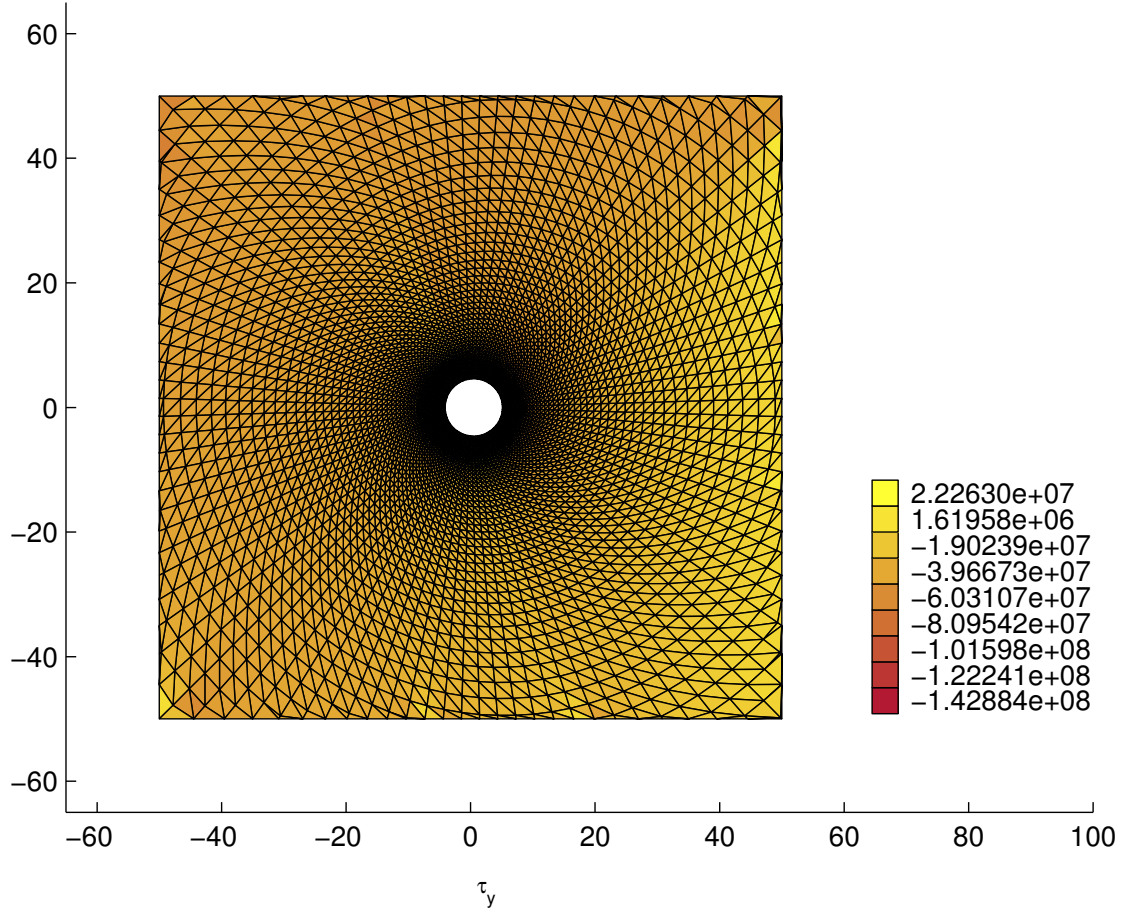


Figure 9: Problem 1 - A detail of stresses τ_y

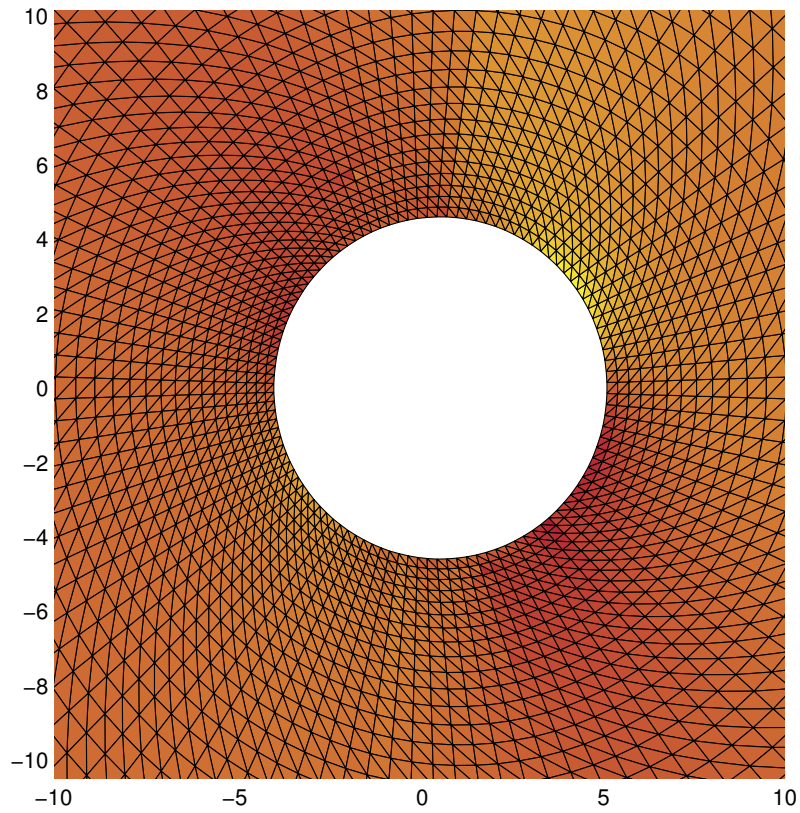
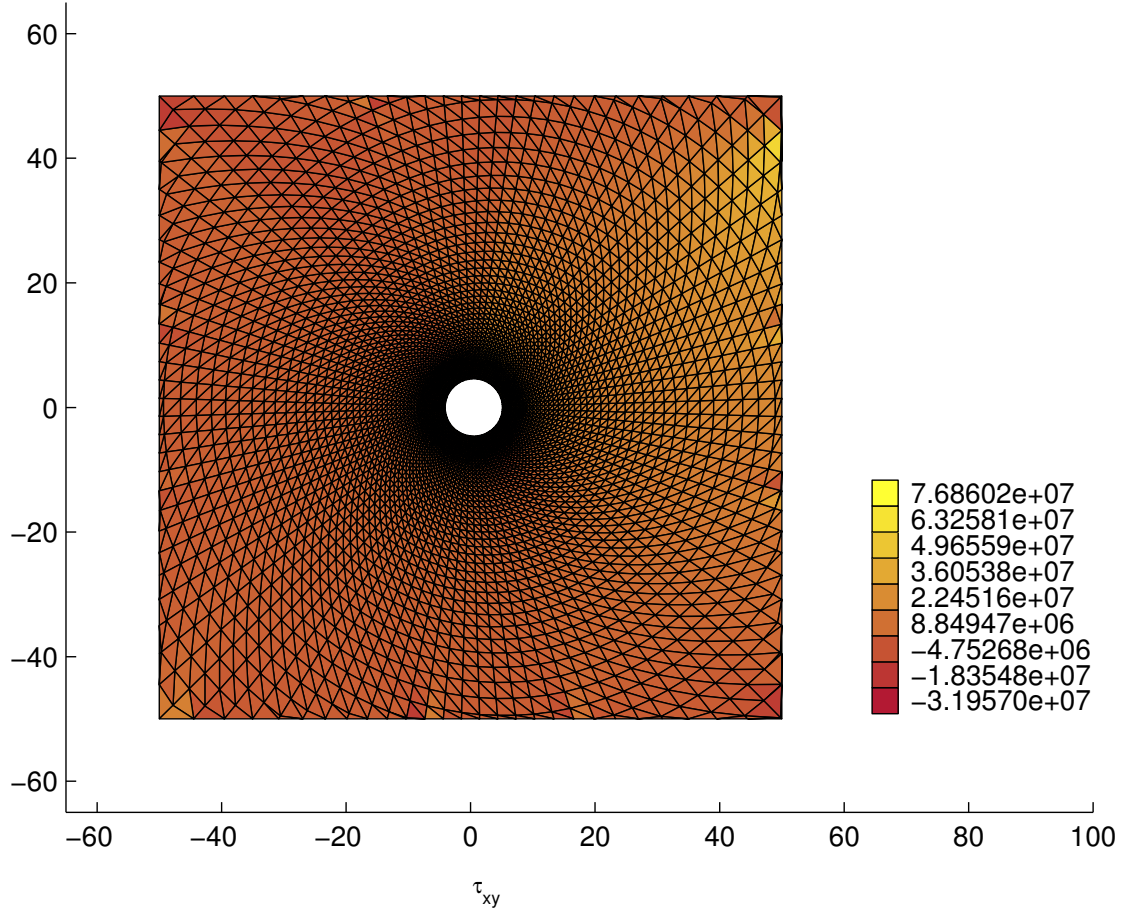


Figure 10: Problem 1 - A detail of stresses τ_{xy}

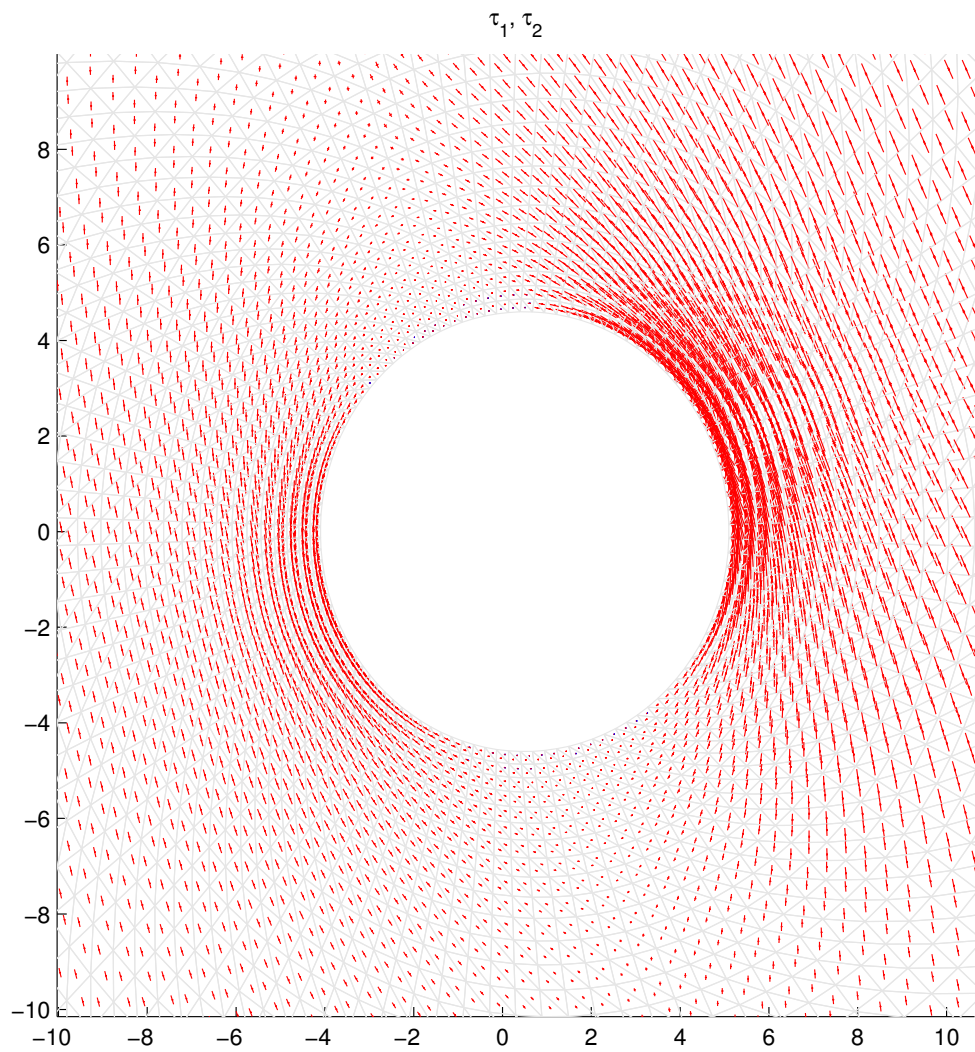


Figure 11: Problem 1 - A detail of principal stresses in neighbourhood of the tunnel.

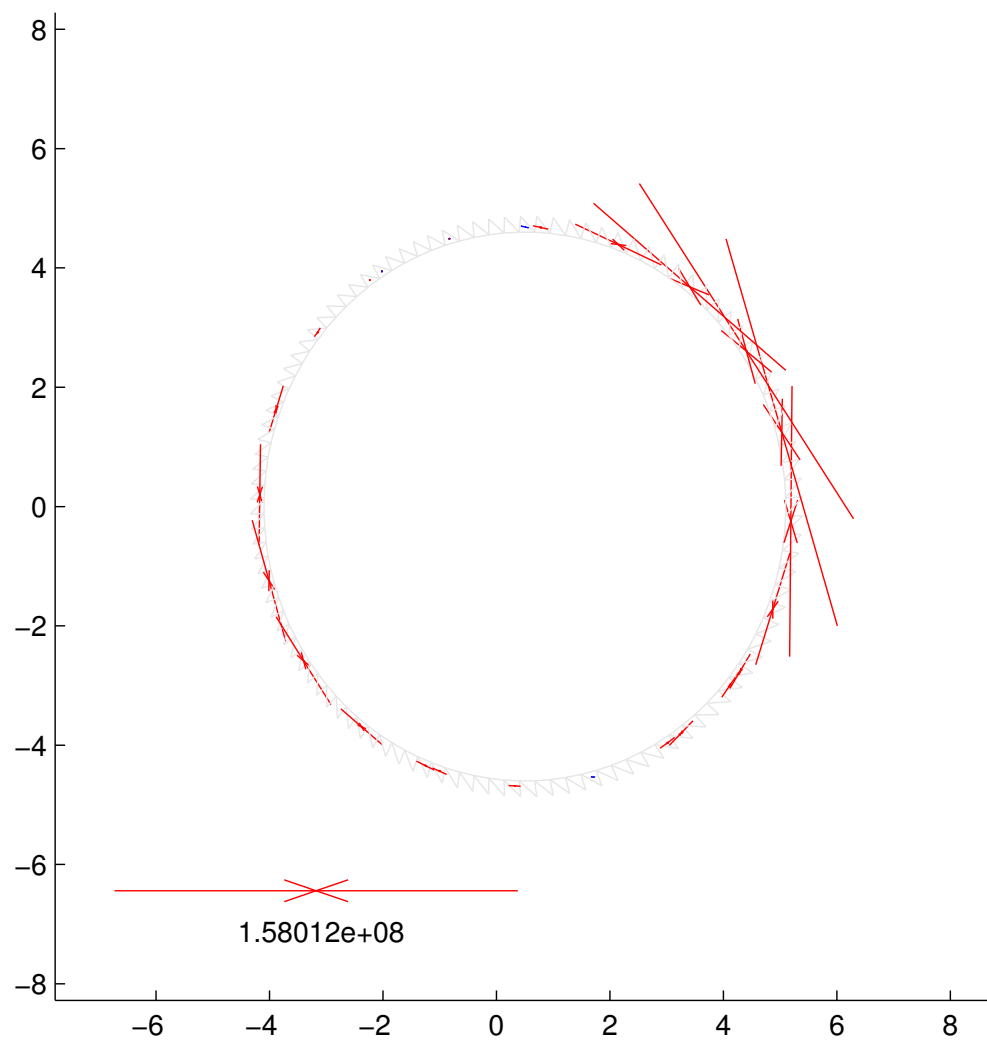


Figure 12: Problem 1 - A detail of principal stresses in neighbourhood of the tunnel.

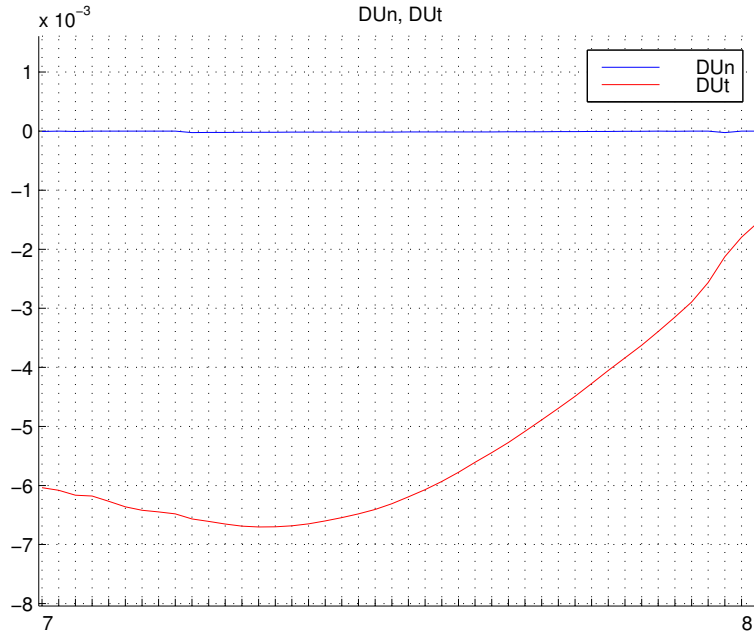


Figure 13: Problem 1 - DU_n , DU_t on contact zone 7-8

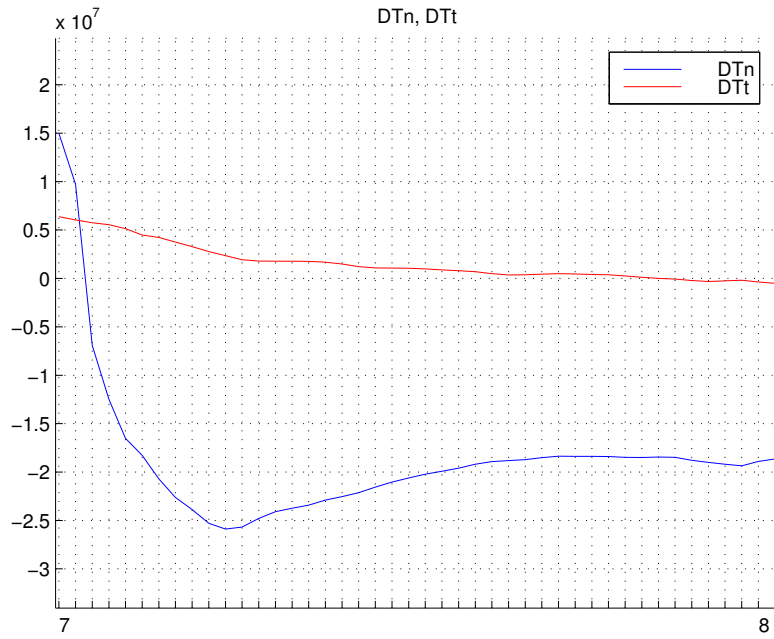


Figure 14: Problem 1 - DT_n , DT_t on contact zone 7-8

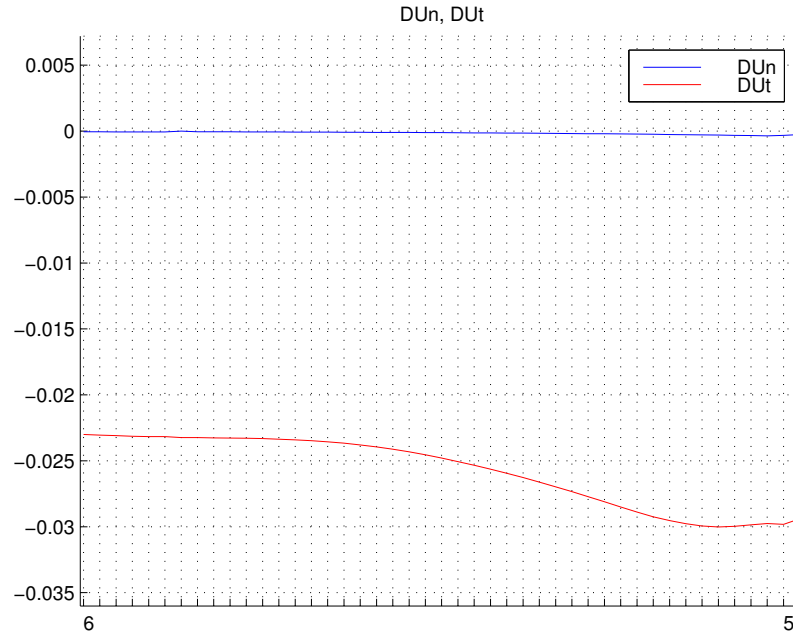


Figure 15: Problem 1 - DU_n , DU_t on contact zone 5-6

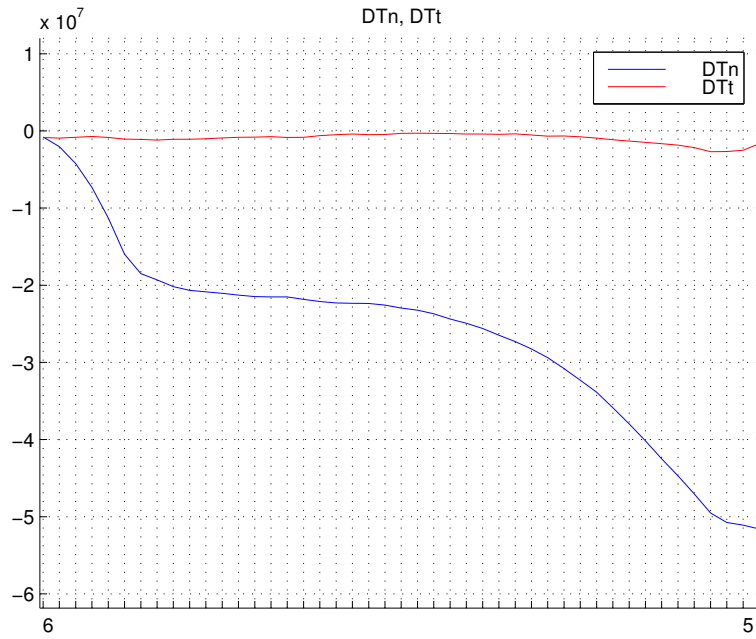


Figure 16: Problem 1 - DT_n , DT_t on contact zone 5-6