Non-Linearity using ABAQUS

Computational Mechanics Tools Homework 4

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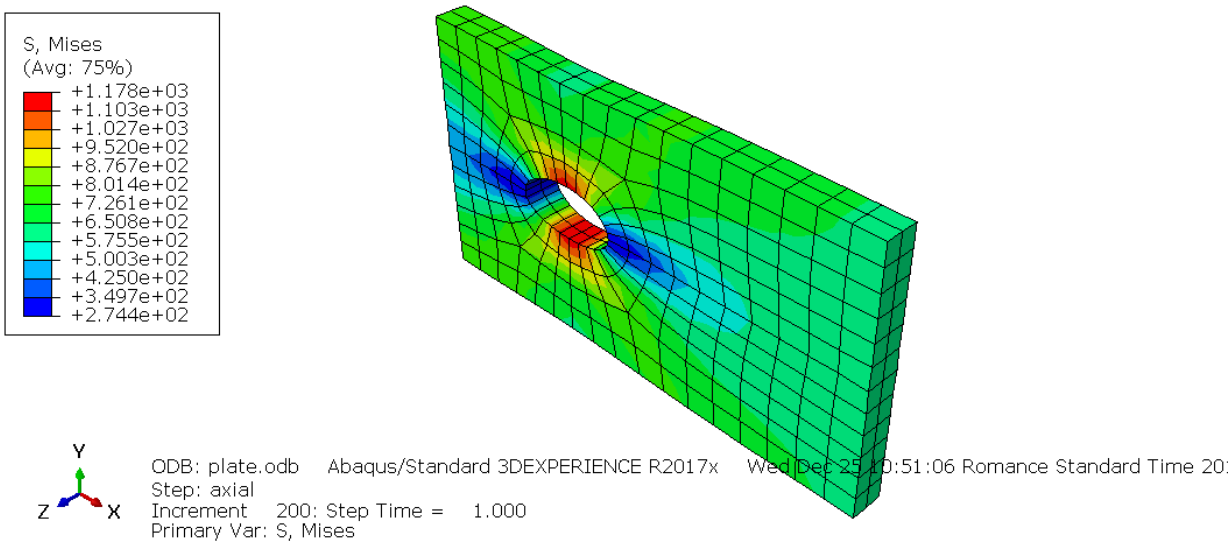
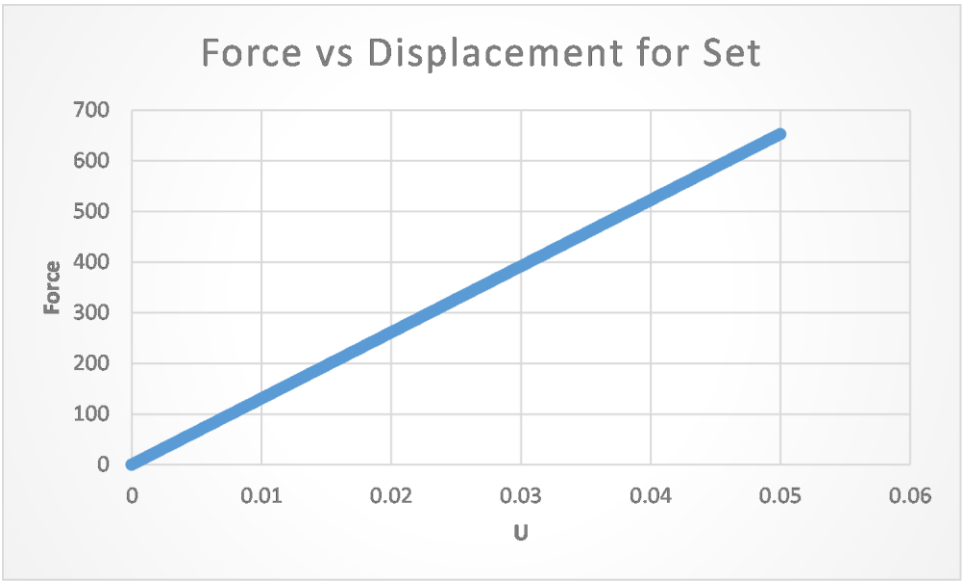
The solutions to the questions are as follows:

Q1 a) The Von-Misses stress contour plot



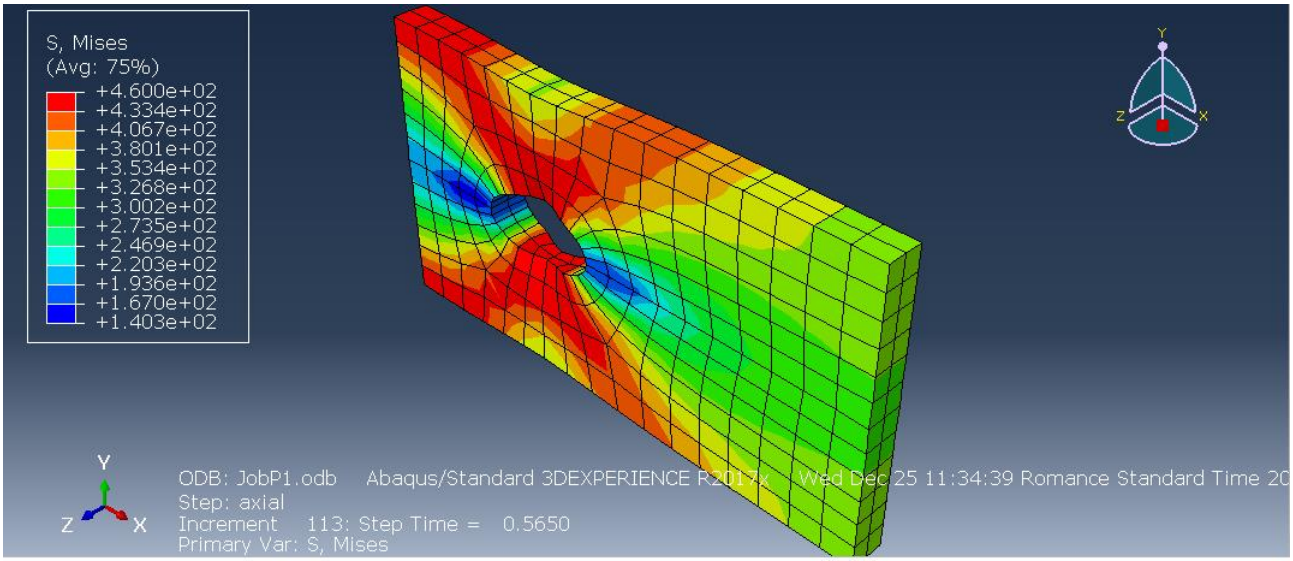
Q1 b) The Force displacement variation with time



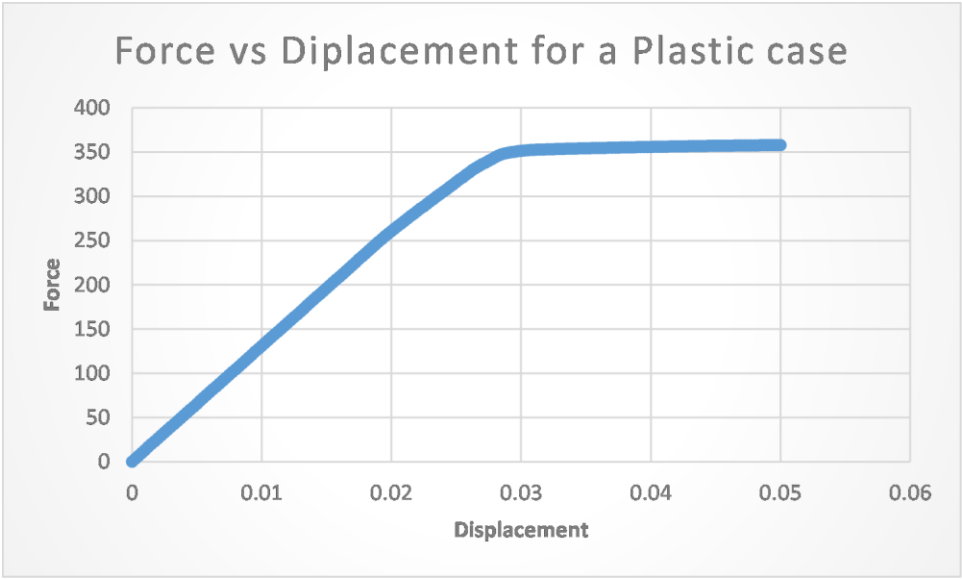
Q1 c).

Case 1: Perfectly plastic at 460 N/mm^2

Contour plot

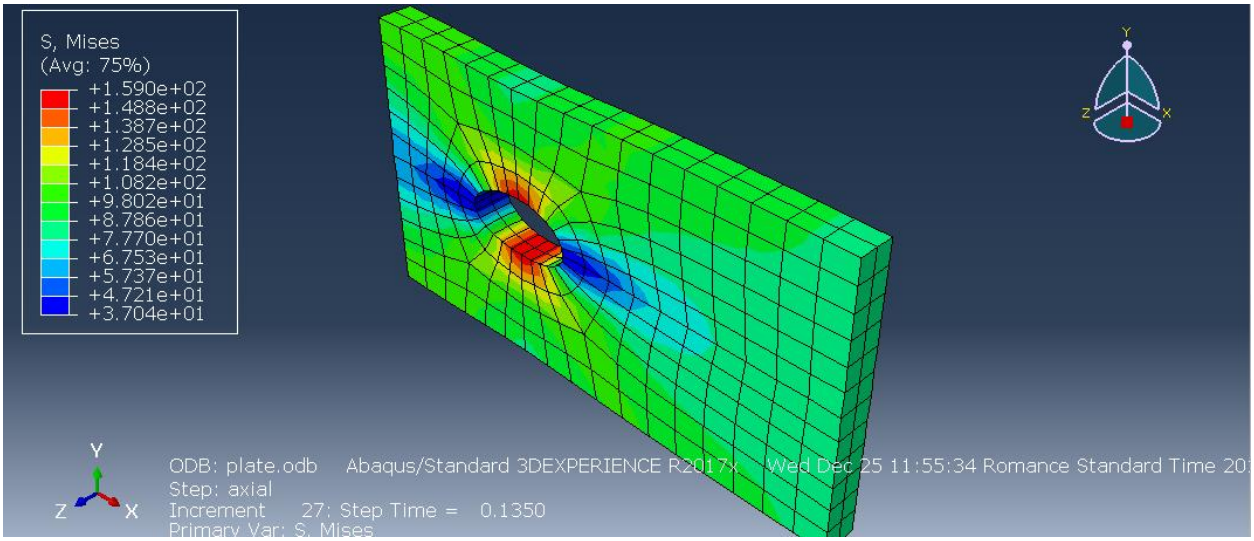


Force vs. Displacement Curve

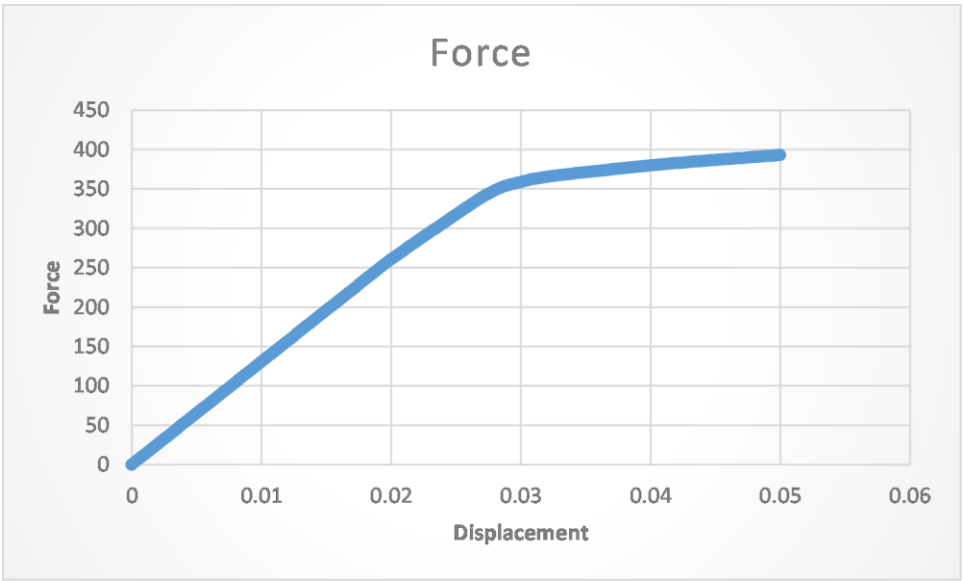


Case 2: with fy=460 N/mm^2, plastic strain=0; fy2=520 N/mm^2, plastic strain = 5.e-3

Contour plot

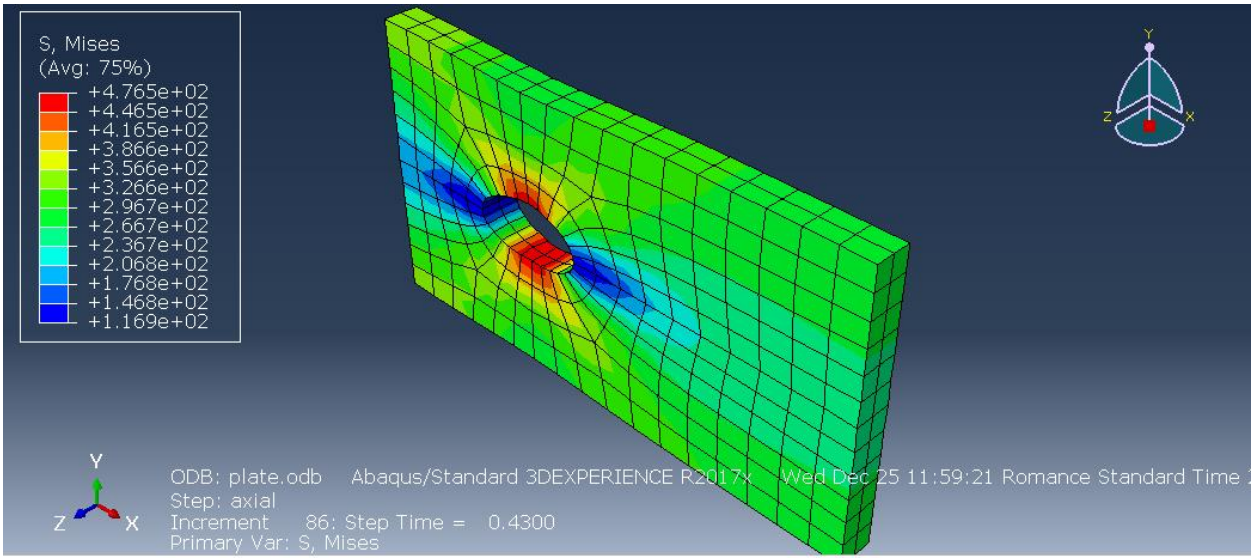


Force vs. Displacement Curve

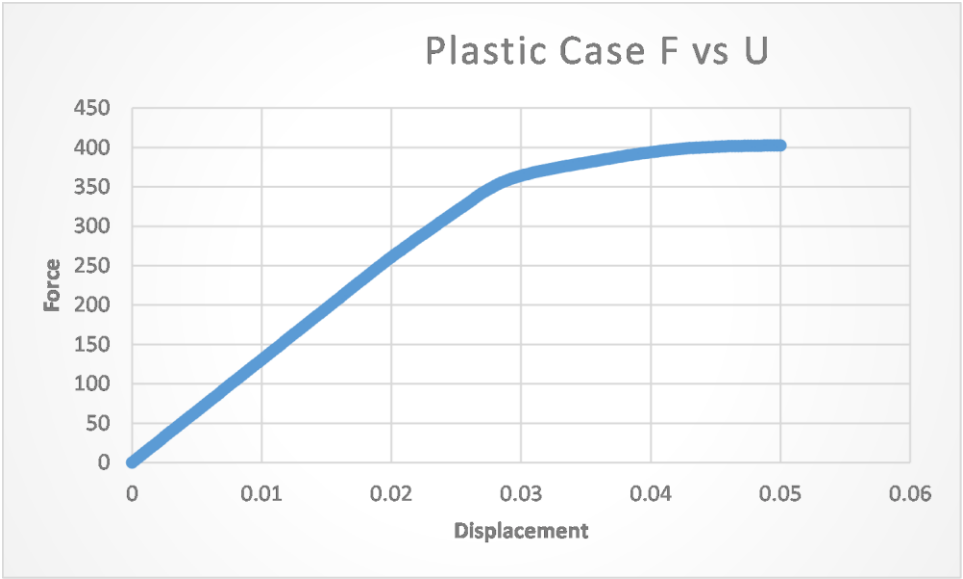


Case 3: with fy=460 N/mm^2, plastic strain=0; fy2=520 N/mm^2, plastic strain = 2.e-3

Contour Plot



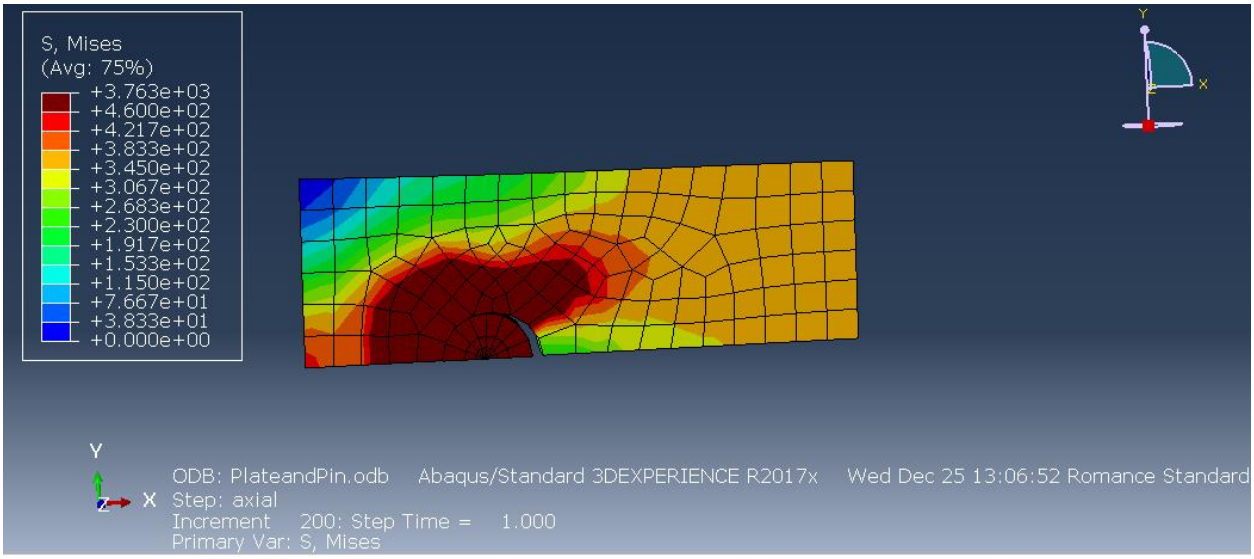
Force vs. Displacement Curve



Discussion: The Force Displacement curve shows elastic behavior till 335 N/mm^2 in all three cases, in the perfectly plastic case, we can see that after that point displacement is caused with very little addition of force as the curve is almost flat. In the second and the third cases the curve is increasing very slowly. The stress required for 0.05mm displacement in the third case is 402.4 N/mm^2 which is slightly larger than that for second case which 393 N/mm^2, this could be attributed to the fact that we have lesser plastic strain limit in the third case.

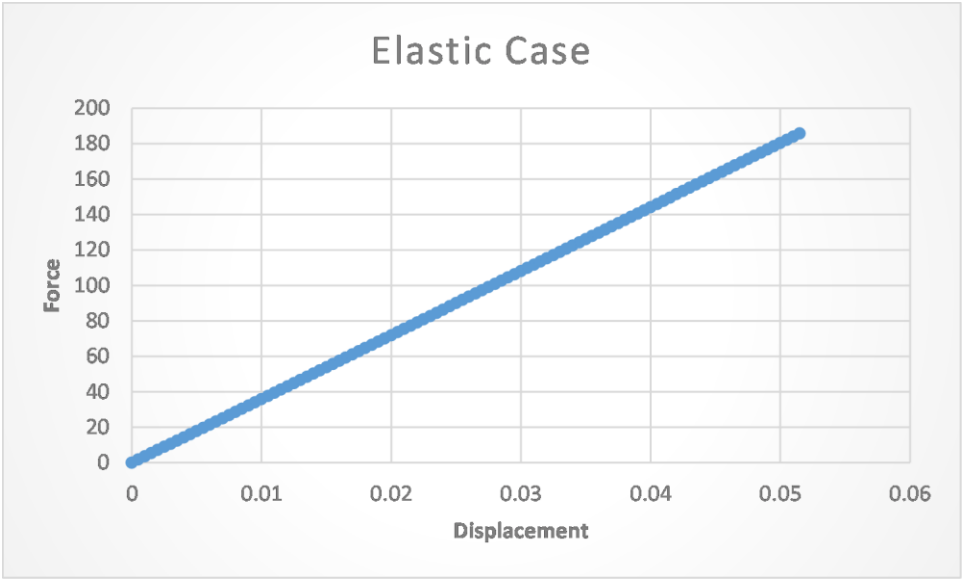
Q2 a)

The Contour plot for the plate-pin structure



Q2 b)

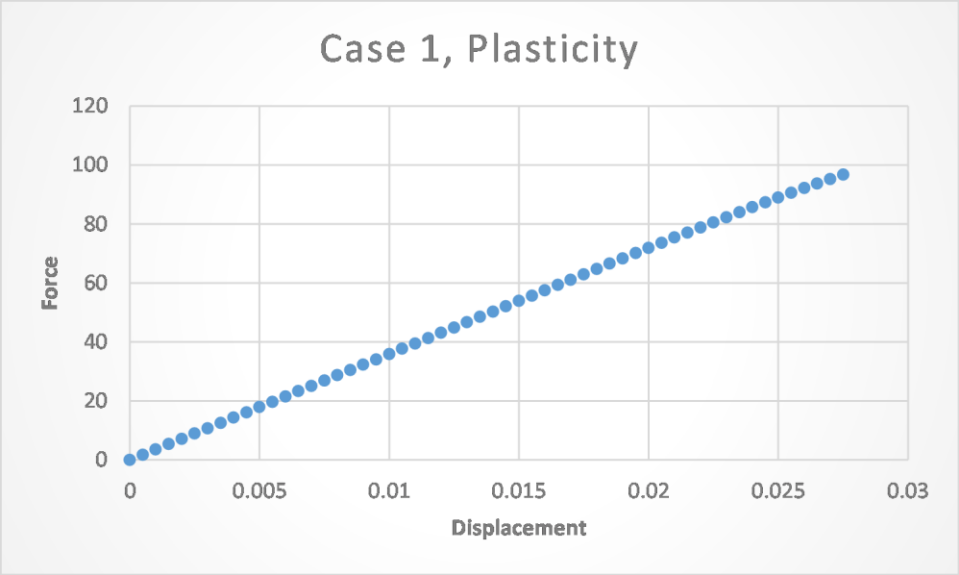
The Force vs. Displacement Curve for the Elastic case is given by



Q2 c) Plasticity is introduced in the materials

Case 1: Plate with fy=460 N/mm^2 , plastic strain=0; fy2=520 N/mm^2, plastic strain = 5.e-3

Pin with fy = 900 N/mm^2, plastic strain = 0.; fy = 1000 N/mm^2, plastic strain = 2.e-3



Case 2: Plate with fy=460 N/mm^2, plastic strain=0; fy2=520 N/mm^2, plastic strain = 5.e-3

Pin with fy = 320 N/mm^2, plastic strain = 0.; fy = 400 N/mm^2, plastic strain = 5.e-3