Computational Mechanics Tools

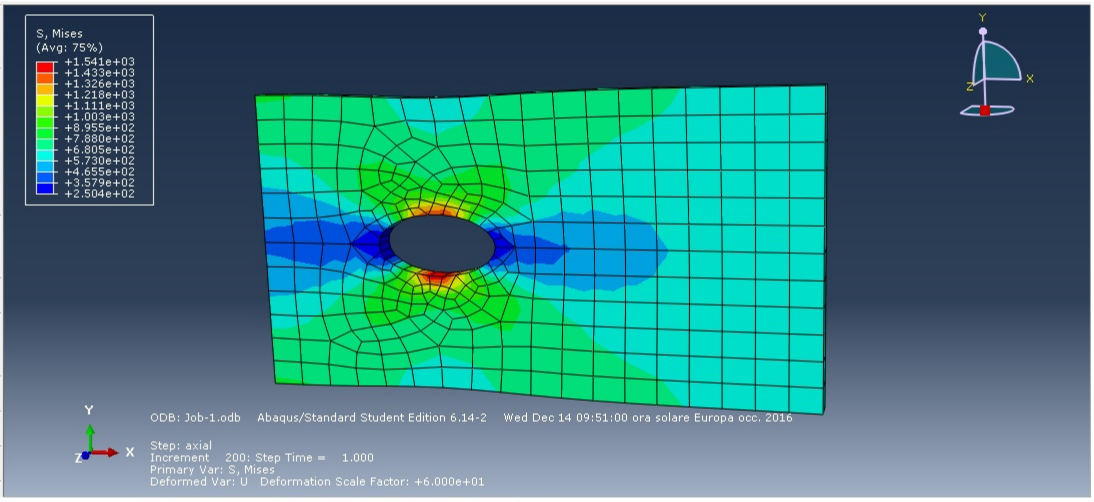
Assignment 3

Luca Azzolin

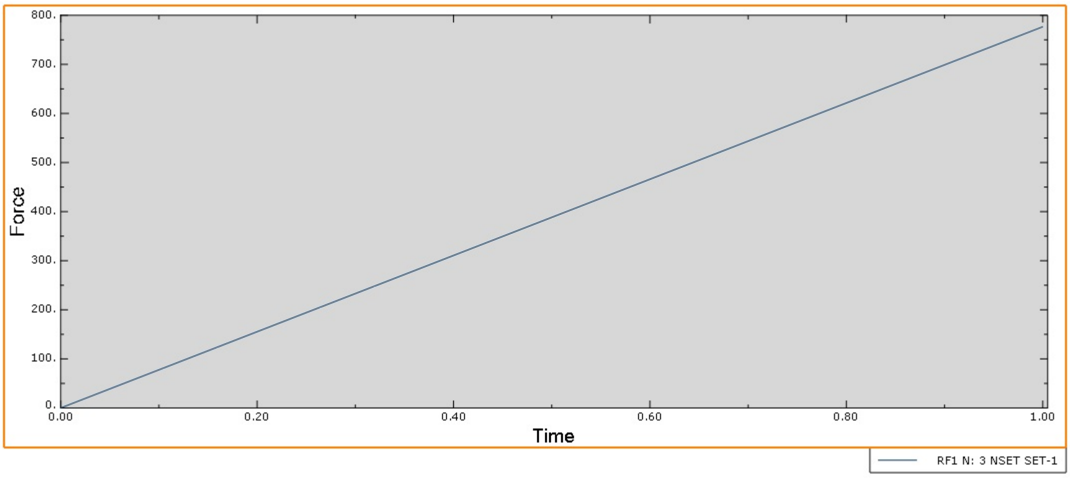
December 20, 2016

Exercise 1

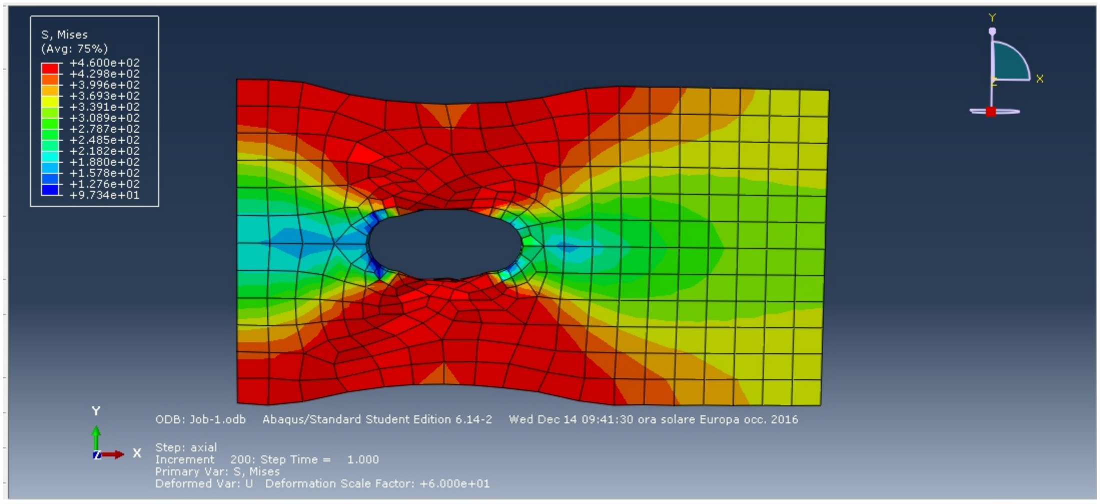
Plot of Von Mises stresses for the elastic plate.



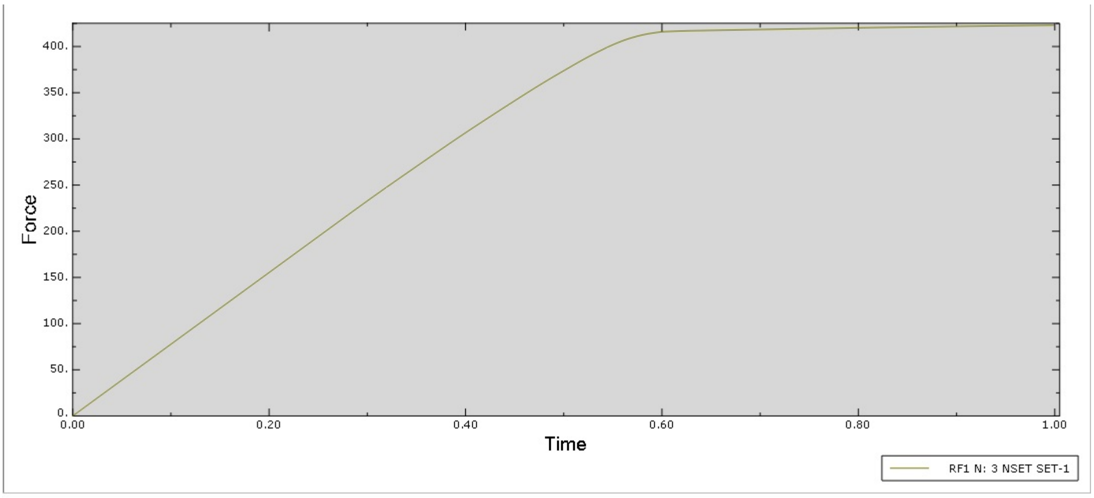
Plot of force-time for the elastic plate. We can see that the plot in this case is perfectly linear as we have a linear relation between strain ϵ and stress σ.



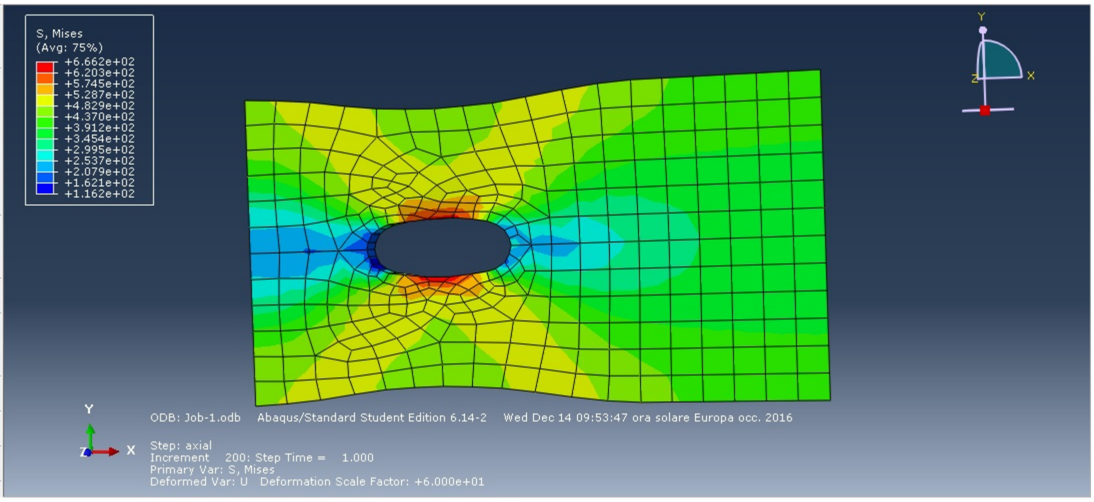
Plot of Von Mises stresses for the isotropic plastic plate.



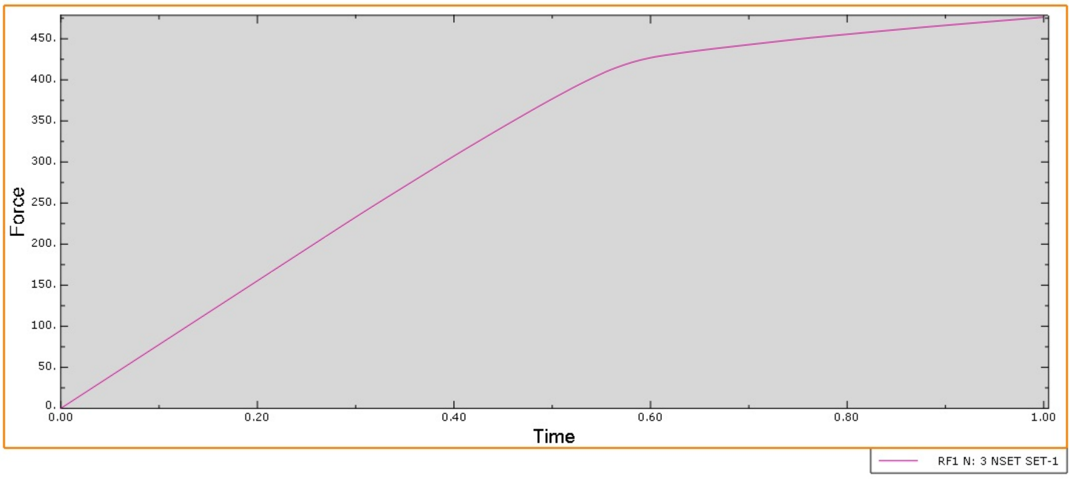
Plot of force-time for the isotropic plastic plate. Using a plastic material we know that we do not have a biunivocal relation between strain ϵ and stress σ. In this case we are plotting a force-time relation of a material with perfect plasticity, and we can distinguish the first elastic branch and then the plastic branch which tends to stabilize to the yield stress (in our case 460 N$\backslash mm^2$), but we will need more time to reach that asymptotic value.



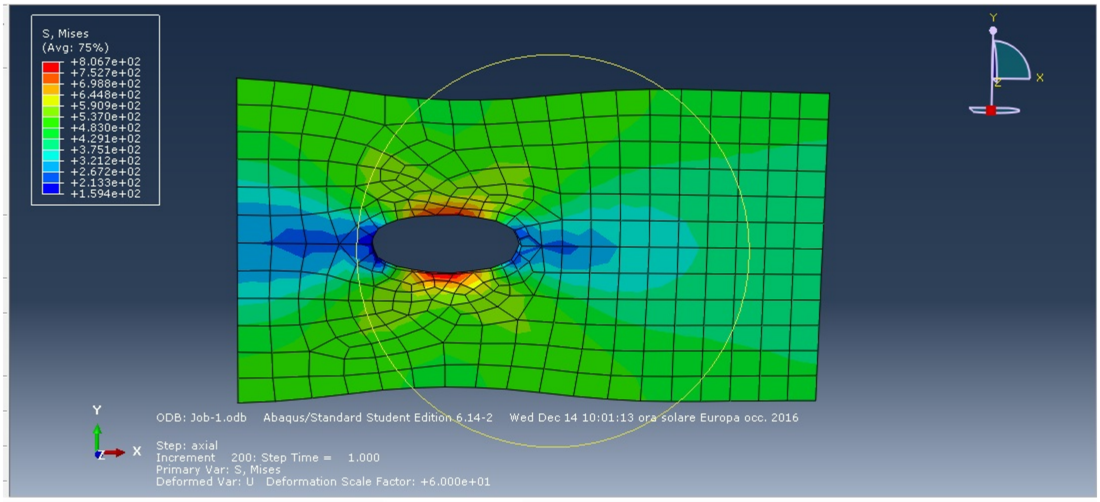
Plot of Von Mises stresses for the kinematic plastic plate, $f_y = 460$, plastic strain=0; $f_{y2} = 520$, plastic strain = 5.e-3.



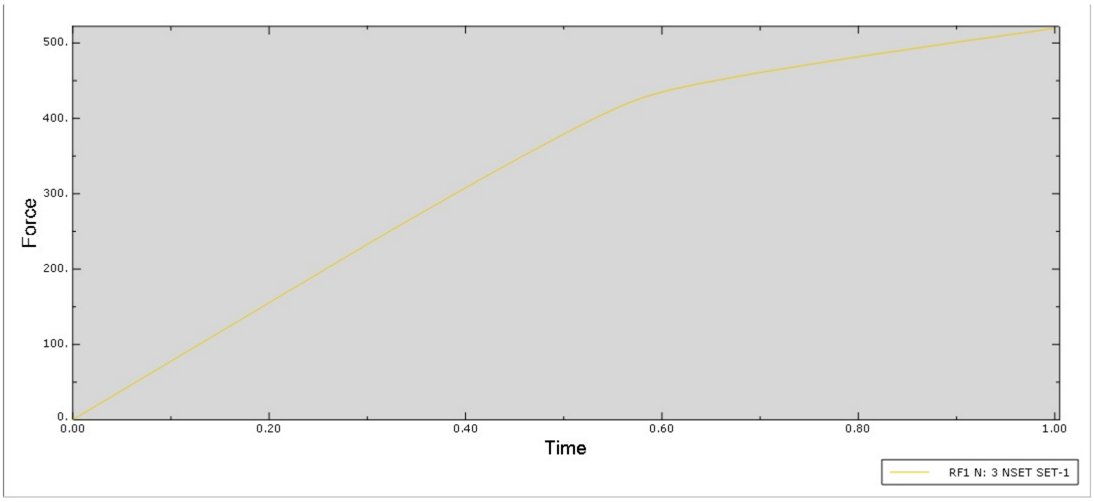
Plot of force-time for the kinematic plastic plate, $f_y = 460$, plastic strain=0; $f_{y2} = 520$, plastic strain = 5.e-3. In this case we have a kinematic hardening plasticity, in fact we can distinguish the first elastic branch and then the plastic one increasing due to the hardening property of the material. In the plot we do not reach the value 520 because the plastic strain is too high for the time taken into account for our simulation.



Plot of Von Mises stresses for the kinematic plastic plate, $f_y = 460$, plastic strain=0; $f_{y2} = 520$, plastic strain = 2.e-3.

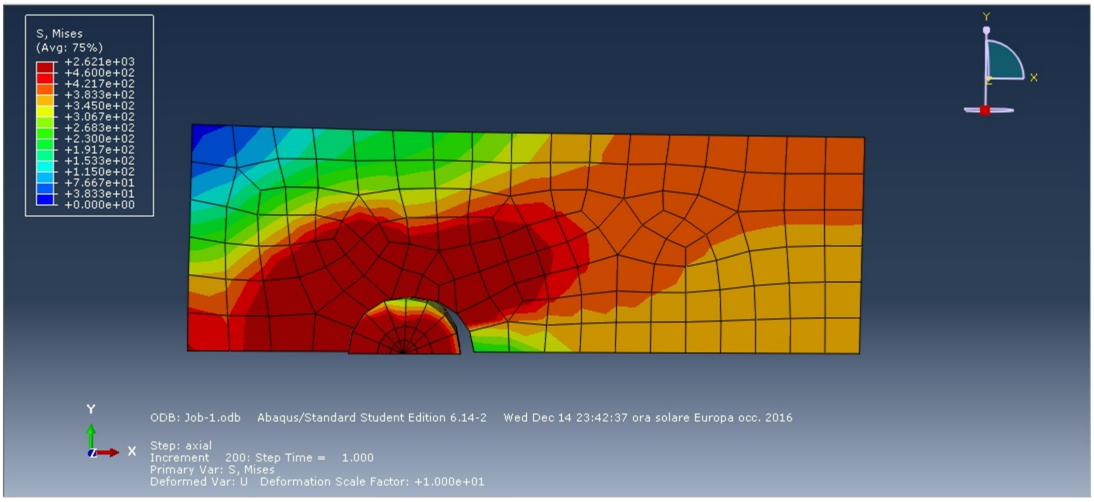


Plot of force-time for the kinematic plastic plate, $f_y = 460$, plastic strain=0; $f_{y2} = 520$, plastic strain = 2.e-3. In this case, as the one before, we have a kinematic hardening plasticity, in fact we can distinguish the first elastic branch and then the plastic one increasing due to the hardening property of the material. In this plot we can see that the time taken into account is enough to reach the maximum value of force, in fact the plastic strain now is lower than before (we have bigger slope).

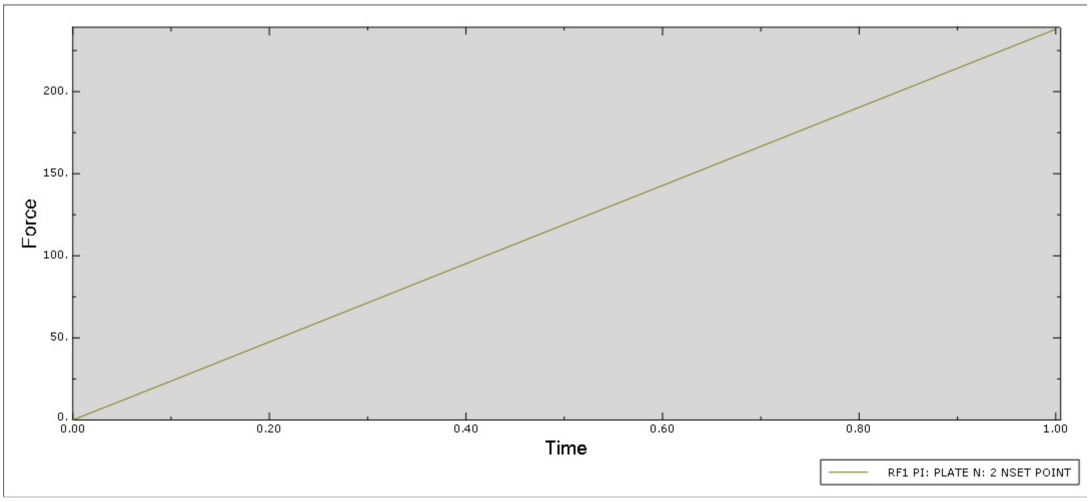


Exercise 2

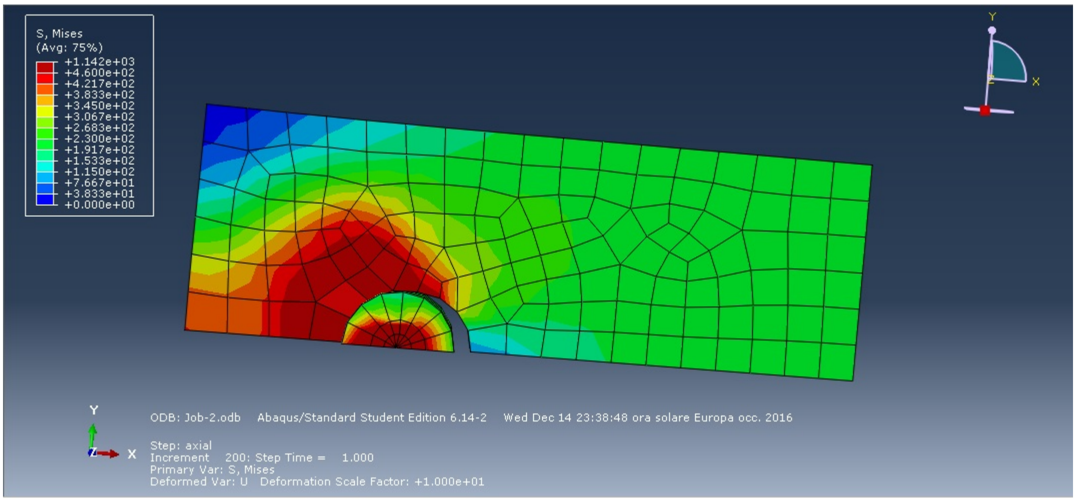
Plot of Von Mises stresses for the elastic plate and elastic pin.



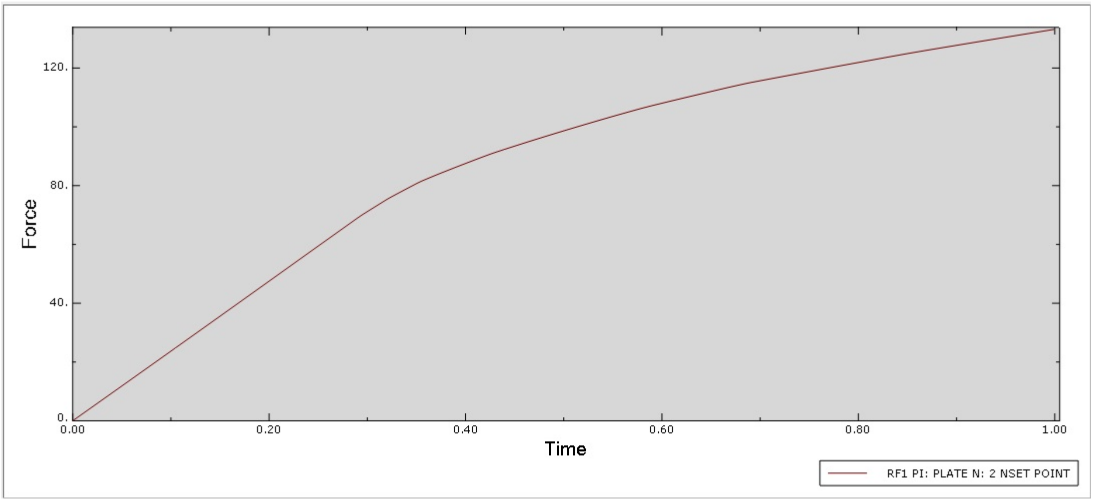
Plot of force-time for the elastic plate and elastic pin. Everything is elastic and in fact we have a linear plot force-time.



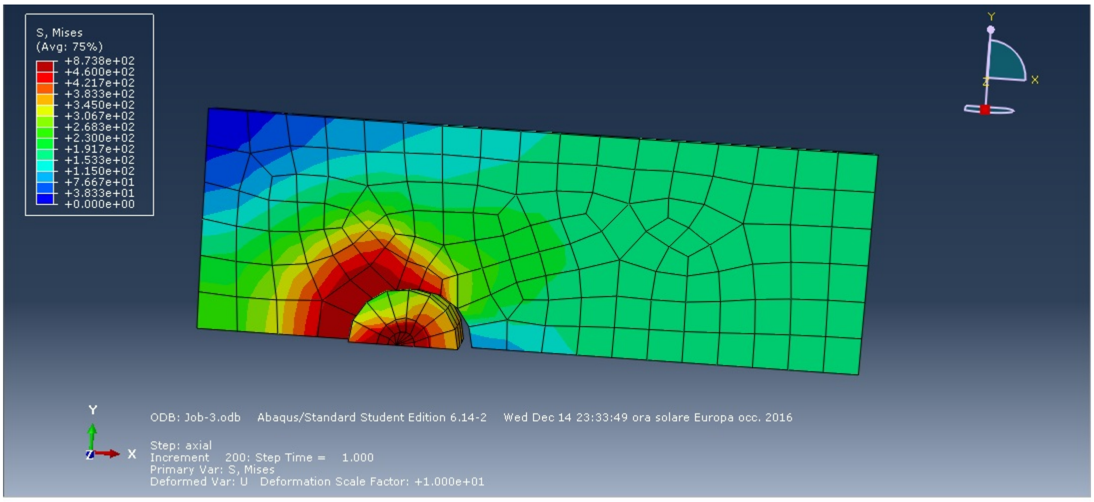
Plot of Von Mises stresses for the kinematic plastic plate, $f_y = 460$, plastic strain=0; $f_{y2} = 520$, plastic strain = 5.e-3 and kinematic plastic pin, $f_y = 900$, plastic strain=0; $f_{y2} = 1000$, plastic strain = 2.e-3.



Plot of force-time for the kinematic plastic plate, $f_y = 460$, plastic strain=0; $f_{y2} = 520$, plastic strain = 5.e-3 and kinematic plastic pin, $f_y = 900$, plastic strain=0; $f_{y2} = 1000$, plastic strain = 2.e-3. In this case we have a kinematic hardening plasticity, in fact we can distinguish the first elastic branch and then the plastic one increasing due to the hardening property of the material. We can see that the maximum value reached on the force axis in one period is around 140.



Plot of Von Mises stresses for the kinematic plastic plate, $f_y = 460$, plastic strain=0; $f_{y2} = 520$, plastic strain = 5.e-3 and kinematic plastic pin, $f_y = 320$, plastic strain=0; $f_{y2} = 400$, plastic strain = 5.e-3.



Plot of force-time for the kinematic plastic plate,f_y = 460, plastic strain=0; f_{y2} = 520, plastic strain = 5.e-3 and kinematic plastic pin,f_y = 320, plastic strain=0; f_{y2} = 400, plastic strain = 5.e-3. Also in this case we have a kinematic hardening plasticity, in fact we can distinguish the first elastic branch and then the plastic one increasing due to the hardening property of the material. We can see that the maximum value reached on the force axis in one period is around 120. This is due to a bigger plastic strain, which means a lower slope and more time to reach higher values of force.