

Lab Assignment 7, 05/16/2019, 1800 -- 2000

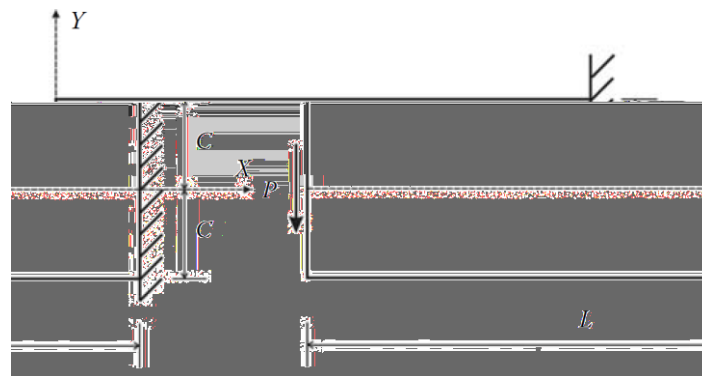
Due 2000

Lab Grading Policy: Attendance 20%, Score 80%, Bonus 20%

You are expected to complete the basic part during the Lab. In case you have difficulty in finishing the basic part on time, you should upload them before 2100 on Saturday and a penalty of 20% discount will be applied on your score. You are encouraged to complete the bonus part (no penalty applied). Basic and/or bonus parts should be submitted by **2100 on Saturday and no late submission is permitted**. We will in general post the reference solutions by **Sunday**.

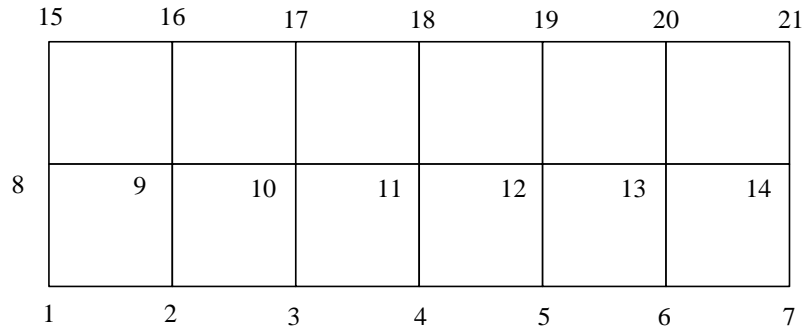
Download [from the course website](#) and unzip it. You will find a folder containing file with seven functions,

- (40%)** Consider a cantilever subjected to a concentrated load shown below. Let us consider it as a plane-stress problem where $C = 10$ mm, $L = 60$ mm, $t = 5$ mm for the geometrical properties, a $\nu = 0.3$, $E = 200,000$ MPa and $\mu = 0.3$ ratio of 0.3 for the material properties, as well as a concentrated force P of 1000 N.

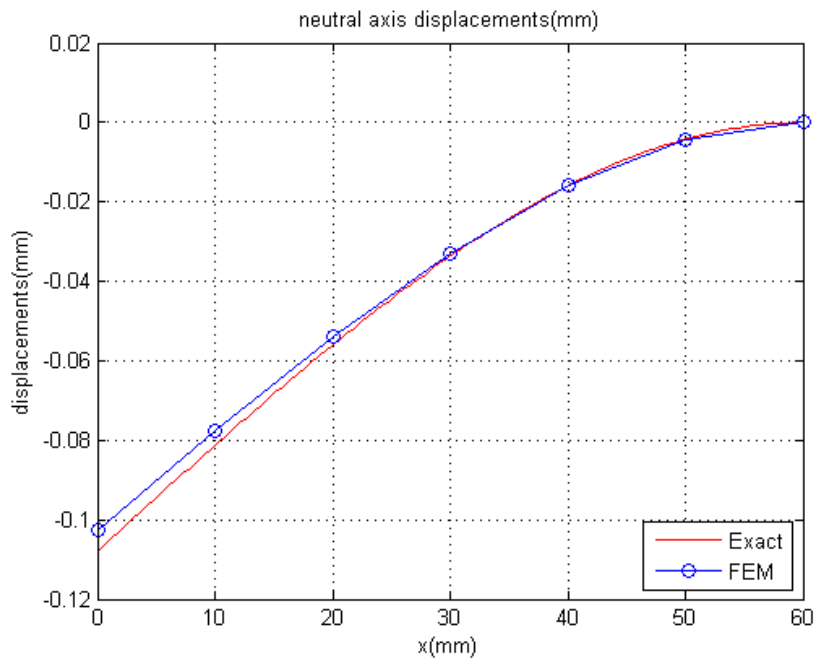
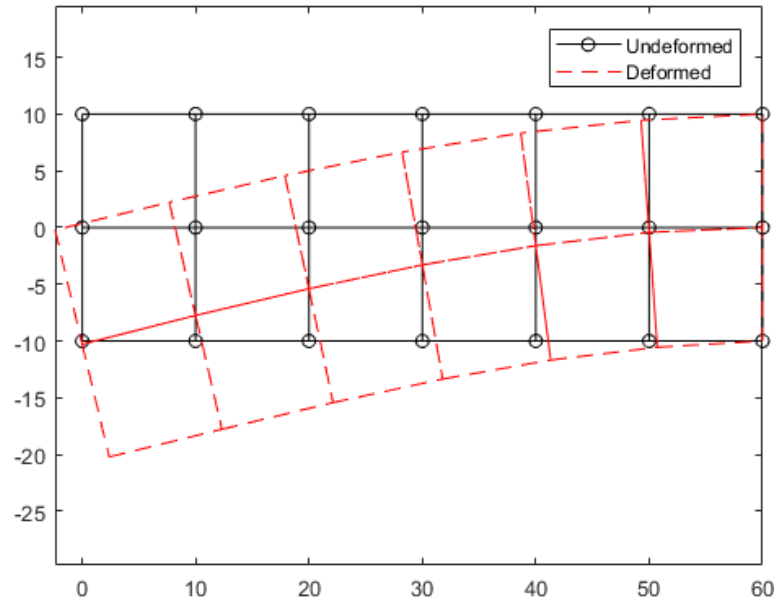


Use 12 rectangular elements to discretize the domain as shown in the figure below. The nodes numbered 7, 14, 21 represent the fixed end. The concentrated force P is applied at node 8. Plot the undeformed and deformed (magnification factor = 100) configurations and the vertical displacement of the nodes situated along the neutral axis of the cantilever and compare the results with analytical solution that gives the vertical displacement of any point in the domain.

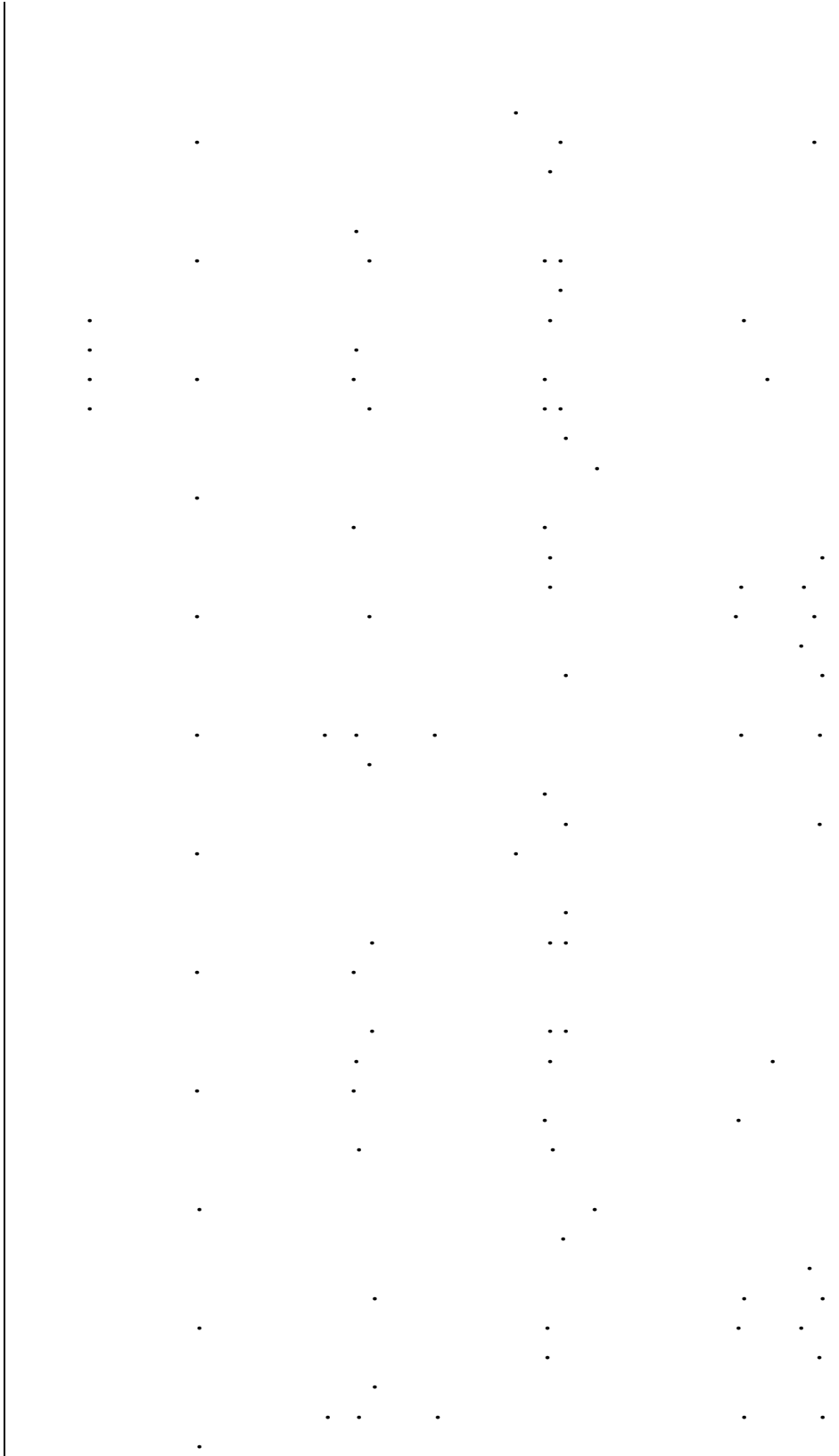
$$u_y = \frac{\nu P x y^2}{2EI} + \frac{P x^3}{6EI} - \frac{P L^2 x}{2EI} + \frac{P L^3}{3EI}$$

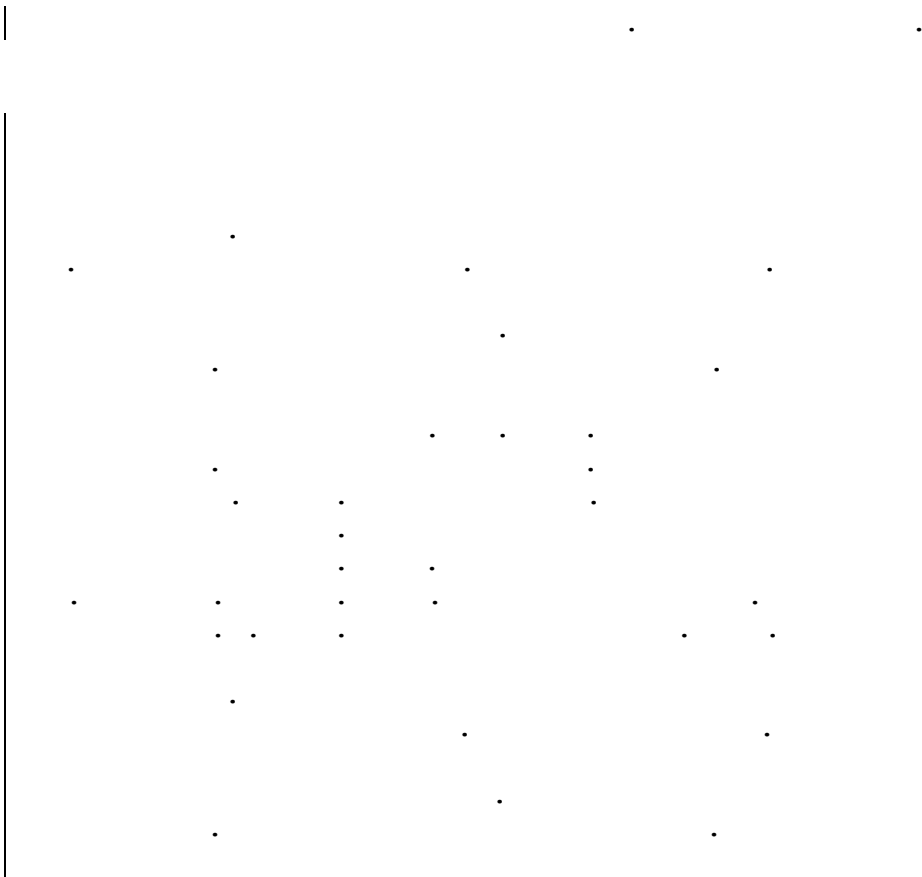


Below are sample plots:



2. (40%) Extend the MATLAB codes to compute the element nodal stresses and average nodal stresses for Problem 1. Average nodal stresses means averaging these element nodal stresses in all elements at a common node to represent the stress at the node. For example, the average nodal stresses for node 9 is derived by summing the nearby 4 element s nodal stress (stress at node 9 from element 1,2,7 & 8) and then dividing them by 4. Below are sample outputs:





3. **(Bonus, 20%; you should finish Problems 1 and 2 first)** Draw discontinuous and continuous σ_{xx} stress contours of Problem 1. When drawing continuous stress contours, using the averaging nodal stresses. When drawing discontinuous stress contours, use the stresses at the element centroid.

12 elements σ_{xx}

