

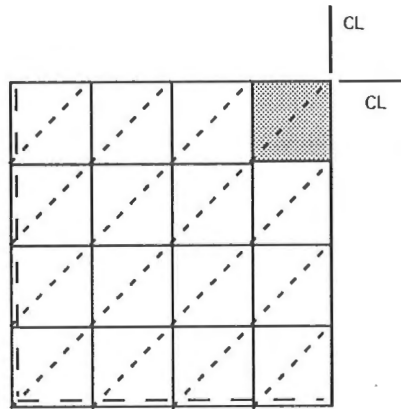
FEM advanced course

9. exercise – plates, stability eigenvalue analysis

1. Analyse using ANSYS the simply supported (hard) square plate subjected to a pressure load acting on the patch shown as dotted area in the figure below. Use a regular 16x16 and 15x15 mesh for a quadrant of the plate. Use element taking the transverse shear deformations into account i.e. the Reissner-Midlin model based element. Length of the plate edge is 1 m and thickness 1 mm ($t/L = 0.001$). Use isotropic elastic material with Young's modulus 70 GPa and Poisson's ratio 0.33.

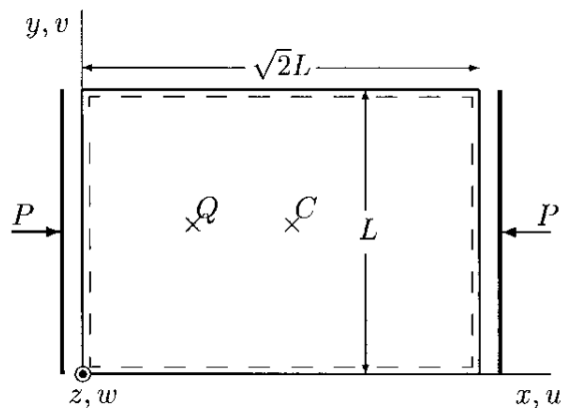
Analyse also a distorted mesh case. You can only move one internal node slightly out of the uniform nodal configuration.

Plot the shear force distribution in both cases.



Home assignment 9.

1. Using Ansys compute the critical buckling loads of the simply supported plate shown below. Use the same material parameters as in the previous exercise and dimensions $L = 1$ m, $t = 1$ mm.



2. Compute the post-buckling behaviour using buckling mode(s) as imperfection to the initial geometry. Compute up to the load which is twice the lowest buckling load. Analyse the following cases.
 - (a) Since the lowest buckling load is of multiplicity two i.e. there exist two buckling modes corresponding to single eigenvalue. Make separate computations using only one of these modes as initial geometry imperfection.
 - (b) Use imperfection taking a combination of the two modes corresponding to the lowest critical load.

Draw the load-displacement curve (deflection at the center and at the quarter point). As the imperfection amplitude use $0.05t = 0.05$ mm. Plot also the buckling modes and contour plots of the membrane forces (N_x, N_y, N_{xy}) at the end of the computation.