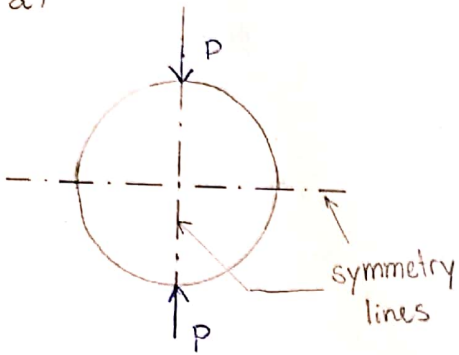


COMPUTATIONAL STRUCTURAL MECHANICS AND DYNAMICS

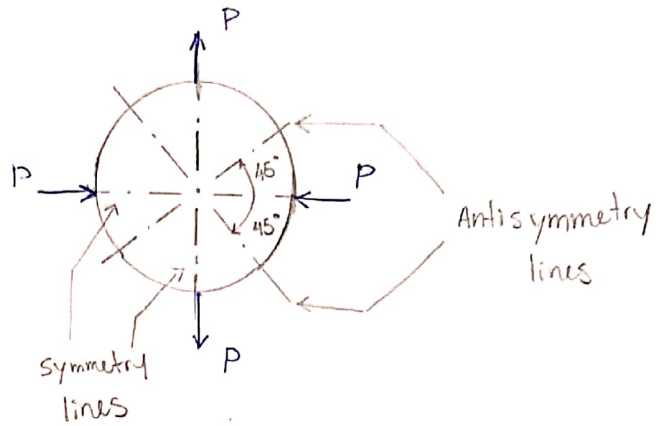
CARLOS EDUARDO RIBEIRO SANTA CRUZ MENDOZA

Assignment 2

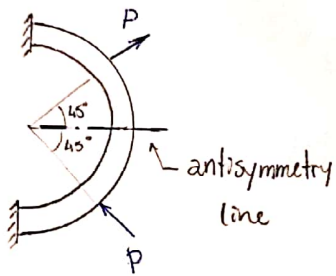
1. a)



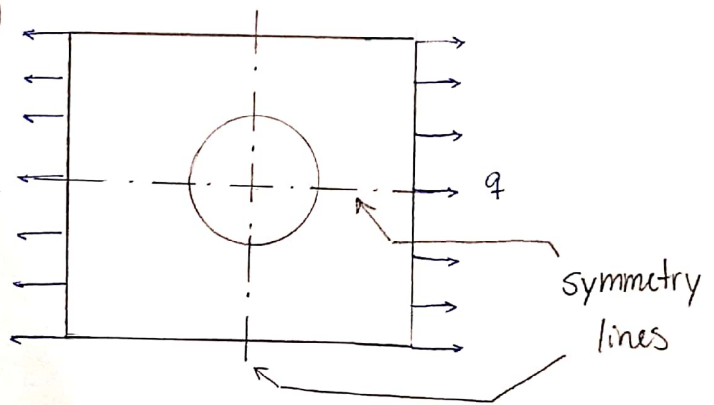
b)



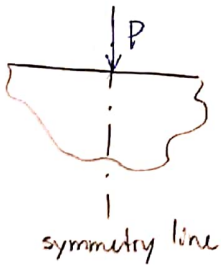
c)



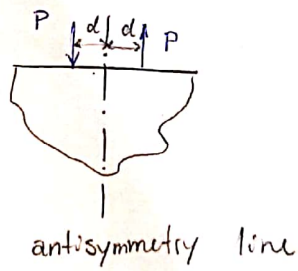
d)



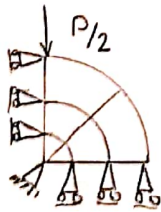
e)



f)



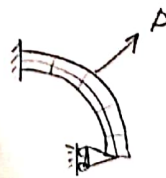
2. a)



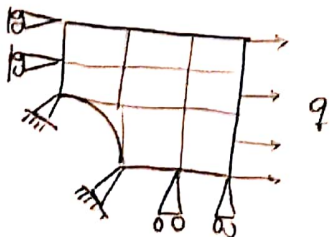
b)



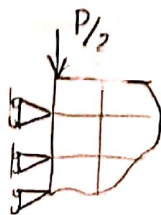
c)



d)



e)



f)

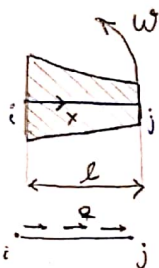


2. TROUBLE SPOTS THAT REQUIRE FINER MESH

A, C, E, G, H, K, L, O → sharp corners

D, I, N → vicinity of concentrated loads and reactions.

3.



$$A = A_i (1 - \xi) + A_j \xi$$

$$\xi = \frac{x - x_i}{l} ; x_i = 0$$

the consistent nodal forces are given by

$$f = \int_0^l q \begin{bmatrix} 1 - \xi \\ \xi \end{bmatrix} l d\xi ; \text{ but } q = \rho A \omega^2 x = \rho A \omega^2 \xi l$$

$$\text{thus } f = \int_0^l \rho A \omega^2 l^2 \xi \begin{bmatrix} 1 - \xi \\ \xi \end{bmatrix} d\xi = \rho \omega^2 l^2 \int_0^1 [A_i (1 - \xi) + A_j \xi] \xi \begin{bmatrix} 1 - \xi \\ \xi \end{bmatrix} d\xi =$$

$$= \rho \omega^2 l^2 \int_0^1 \begin{bmatrix} A_i (\xi - 2\xi^2 + \xi^3) + A_j (\xi^2 - \xi^3) \\ A_i (\xi^2 - \xi^3) + A_j \xi^3 \end{bmatrix} d\xi =$$

$$= \rho \omega^2 l^2 \begin{bmatrix} A_i (\xi^2/2 - 2\xi^3/3 + \xi^4/4) + A_j (\xi^3/3 - \xi^4/4) \\ A_i (\xi^3/3 - \xi^4/4) + A_j \xi^4/4 \end{bmatrix} \Big|_0^1 \Rightarrow$$

$$f = \rho \omega^2 l^2 \begin{bmatrix} (A_i + A_j)/12 \\ (A_i + 3A_j)/12 \end{bmatrix}$$

considering a prismatic bar $A_i = A_j = A$ yields

$$f = \rho \omega^2 l^2 A \begin{bmatrix} 1/6 \\ 1/3 \end{bmatrix}$$