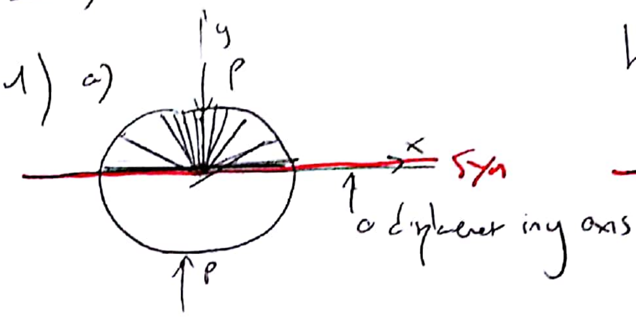
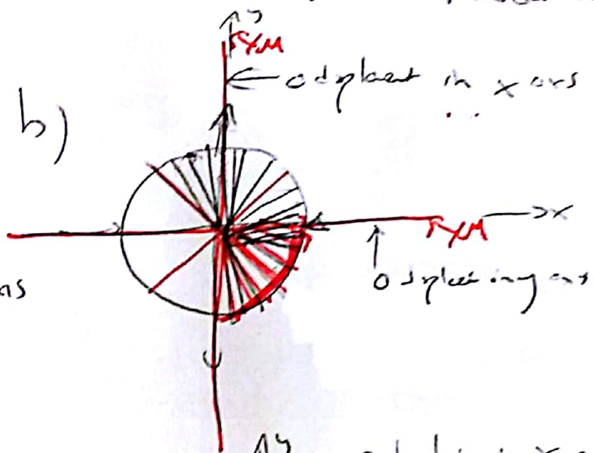
Computational Structural Mech. & Dynam.   Marcos Bonquet

Assignment 2.1

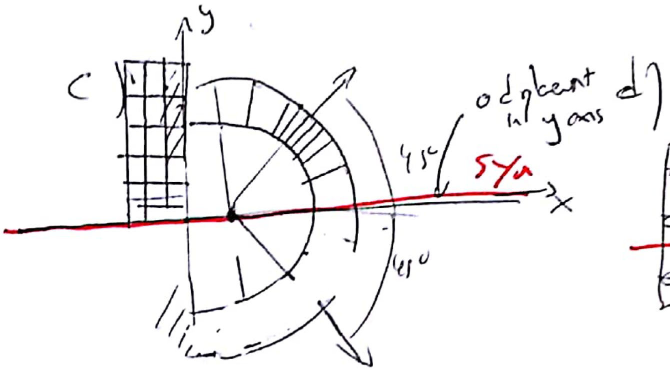
1) a)



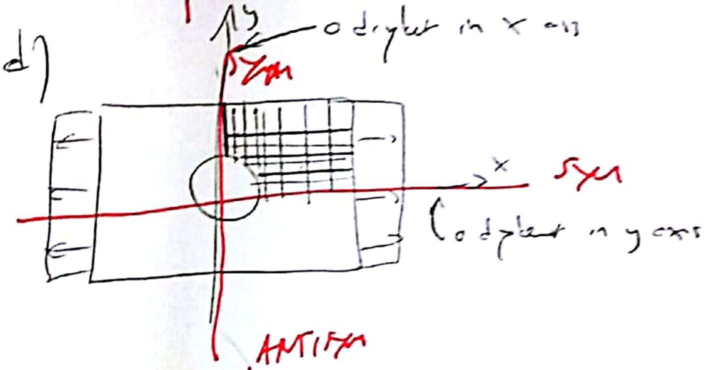
b)



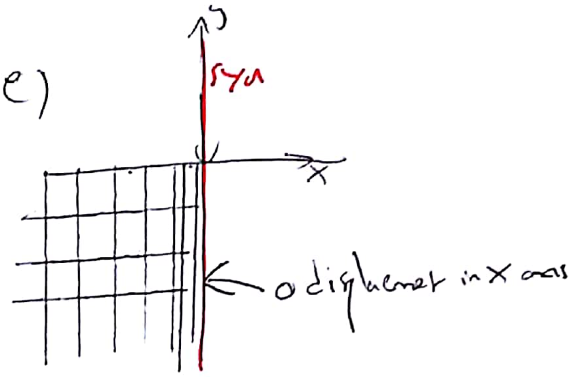
c)



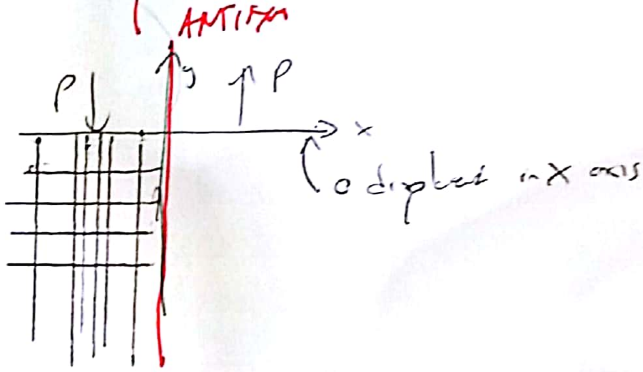
d)



e)



f)



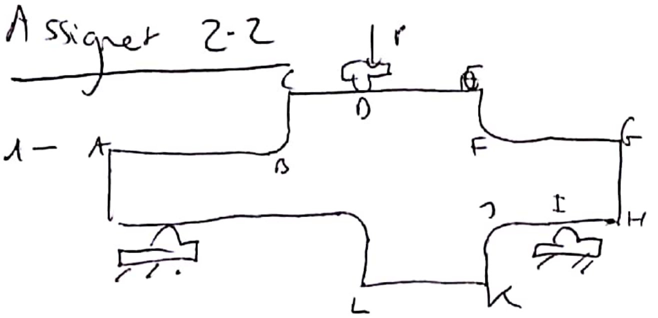
2) Is it possible to cut to a half or a quarter?

a) to a <u>half</u>
b) to a <u>quarter</u>
c) to a <u>half</u>
d) to a <u>quarter</u>
e) to a <u>half</u>
f) to a <u>half</u>.

Scanned by CamScanner

Assignment 2-2

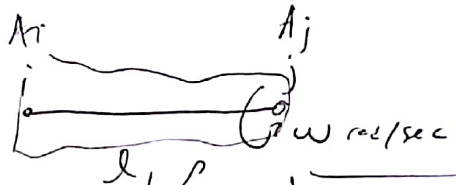
1 –



Trouble spots: (Require finer finite element): $\boxed{B, D, F, I, J, M, N}$

Entrant corners and Concentrated loads are here the reason to use finer mesh.

Assignment 2-3



$\boxed{q(x) = \rho A \omega^2 x}$

1.

$$A = A_i \underbrace{(1-\xi)}_{N_1} + A_j \underbrace{\xi}_{N_2}$$

- Find node forces as functions of ρ, A_i, A_j, ω, and l.
- Specialize for a prismatic bar $A = A_i = A_j$

$$f_{ext} = \int_0^1 q \begin{bmatrix} 1-\xi \\ \xi \end{bmatrix} l \, d\xi = \int_0^1 \rho A \omega^2 x \begin{bmatrix} 1-\xi \\ \xi \end{bmatrix} l \, d\xi =$$

$$= \omega^2 \rho l \int_0^1 (A_i(1-\xi) + A_j \xi) \underset{l \cdot \xi}{\times} \begin{bmatrix} 1-\xi \\ \xi \end{bmatrix} d\xi = \omega^2 \rho l^2 \int_0^1 [A_i(1-\xi) + A_j \xi] \, \xi \begin{bmatrix} 1-\xi \\ \xi \end{bmatrix} d\xi$$

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

$$= \omega^2 \rho l^2 \cdot \begin{bmatrix} A_i\left(\frac{\xi^2}{2} - \xi^2 + \frac{\xi^4}{4}\right) + A_j\left(\frac{\xi^3}{3} - \frac{\xi^4}{4}\right) \\ A_i\left(\frac{\xi^3}{3} - \frac{\xi^4}{4}\right) + A_j\left(\frac{\xi^4}{4}\right) \end{bmatrix}$$

if $A_i = A_j \longrightarrow$ $\boxed{f_{ext} = \omega^2 \rho l^2 A \begin{bmatrix} -\frac{\xi^2}{2} + \frac{\xi^3}{3} \\ \frac{\xi^3}{3} \end{bmatrix}}$

Scanned by CamScanner