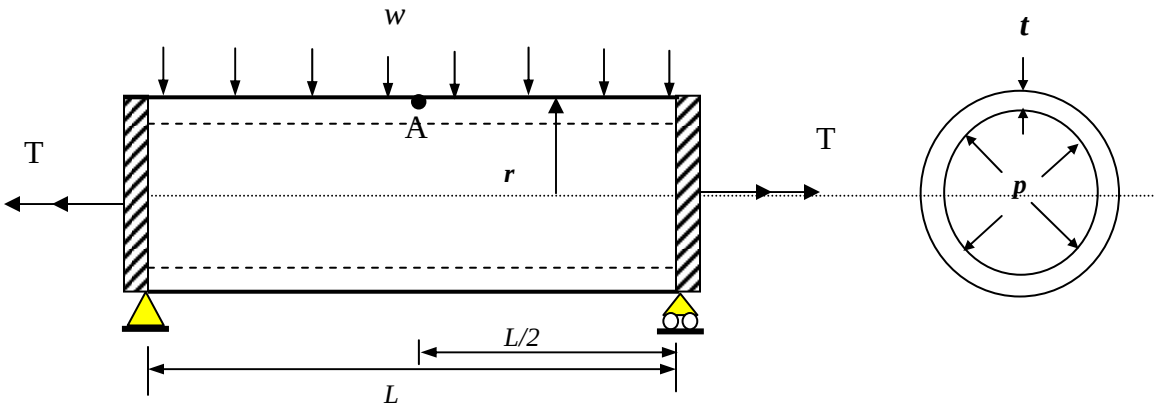
CE 327: Analysis and Design Software Lab
Assignment 2

A thin walled closed pressure vessel of length *L*, mean radius *r* and thickness *t* is simply supported at its two ends as shown. The tube is filled with pressure *p*, subjected to a uniformly distributed self-weight of *w* per unit length and torsion T as shown.

(a) Show the magnitude and direction of stress components on a neatly sketched stress block at point A, located at the mid point of the tube. Choose a coordinate system of your choice.
(b) Calculate the principal stresses and strains (i.e max/min normal stresses and strains) and their orientations.
(c) Assuming the material to be ductile, check if the failure may occur at A for a factor of safety equals to 2. Use (1) Tresca failure theory (2) Von Misses failure theory

Assume w = 10 kN/m, p = 2 MPa, T= 20kN-m, r = 0.25 m, t = 5 mm, L = 2 m, E = 70 GPa, $\upsilon = 0.3$, σ_{yp}=250 MPa



Problem 2

A thin rectangular plate of length a = 300mm, width b = 200 mm and thickness t = 2 mm is made of an aluminum alloy ($E=72\ GPa, \nu = 0.33$). The stress components σ_x and σ_y are uniformly distributed as shown.

a) If $\sigma_y = 200\ MPa$, determine the magnitude of σ_x such that the width a = 300 mm does not change.

Hence, determine the following:

b) the change in length of the diagonals.

c) the principal stresses, maximum shearing stress and their orientations.

(d) Can you identify the possible failure planes for the aluminum alloy plate?

(e) If the material is changed to cast iron, how do you expect the failure to happen, given all the variables remain unchanged except for the material properties.

Assume plane stress, i.e. σ_{zx} **,** σ_{zy} ***and*** σ_z ***to be zero.*** **Hint: Apply Hooke's law carefully!**