7/5/2020 1pm

CAE 3 Stress analysis M5X02064

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Question 1.

A) Hoop stress in a thin cylinder is given by

$$\sigma_H = \frac{Pd}{2t}.$$

Due to the internal pressure, total force on half the cylinder is:

$F = P \times A$ Resolved vertically.

which gives/becomes:

pdL or $P \times dL$.

The resisting force or downwards force is

$2\sigma_H \times Lt$.

Thus, $2\sigma_H Lt = pdL$

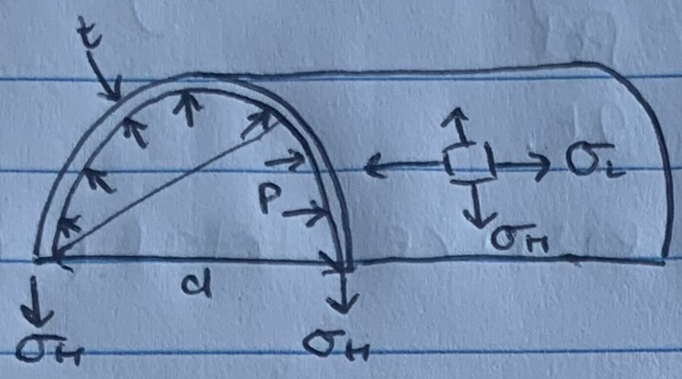
Cancel out L and rearrange for σ_H gives:

Hoop stress: $\sigma_H = \frac{Pd}{2t}$.

B) This is a limiting factor for a thin cylinder because compared to a longitudinal stress the hoop stress is twice the longitudinal stress, which means the thin cylinders cannot hold fluids at the same higher pressure that longitudinal stresses can. Therefore limiting the thin cylinder.

C) 1.0285 g/m³ or 0.001285 kg/m³

D)



Rearrange $\sigma_H = \frac{Pd}{2t}$ for P

$= 2\sigma_H t = Pd$.

$= \frac{2\sigma_H t}{d} = P$

Substitute P for ρgh. so it becomes

$$\rho gh = \frac{2\sigma_H t}{d}$$

Then rearrange for h so

$$\frac{2\sigma_H t}{d\rho g} = h$$

$t = 2.5mm$ $\sigma_H = 195$ MPa $d = 2.5$

$\rho = 0.001285$ $g = 9.81$

Substitute the values into the formula.

D cont.) $\frac{2\sigma_H t}{dp\,g} = h.$

$\frac{2 \times 195 \times 2.5 \times 10^{-3}}{2.5 \times 0.001285 \times 9.81} = h.$

$h = 30.9$ feet.

E) $h = \frac{2\sigma_H t}{dP}.$

$= \frac{2 \times 195 \times 2.5 \times 10^{-3}}{2.5 \times 0.1.}$

$h = 3.9$ feet

F) 7.8 feet.

(4) The values are low.

F) The results would differe in a normal Scenario because the values of the variables ie pressure and yield Stress would not be assumed they would be calculated or measured accurately.

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Question 2.

A) A is define the problem.
This task is to determine the definition of the problem, so, for example: what is the problem? This may include a process that has multiple steps to define the problem. These steps are develope a problem statement and establish criteria for success.

B: is gather relevant information relating to the problem. This could be finding facts about the problem that could possibly take you back to A (above). There are multiple questions that could be asked when using this task such as is the solution profitable? Another step included in this task is searching for resources that can provide information such as electronic sources and publications.

C is generate multiple solutions.
This task is about generating ways in which the problem could be solved although not all of the ways would be used. Braunstorming ideas that could be used in the solutions is very useful for this step. Discovering their strengths and weakness can be very important as this could lead to combining ideas creating a unique solution.

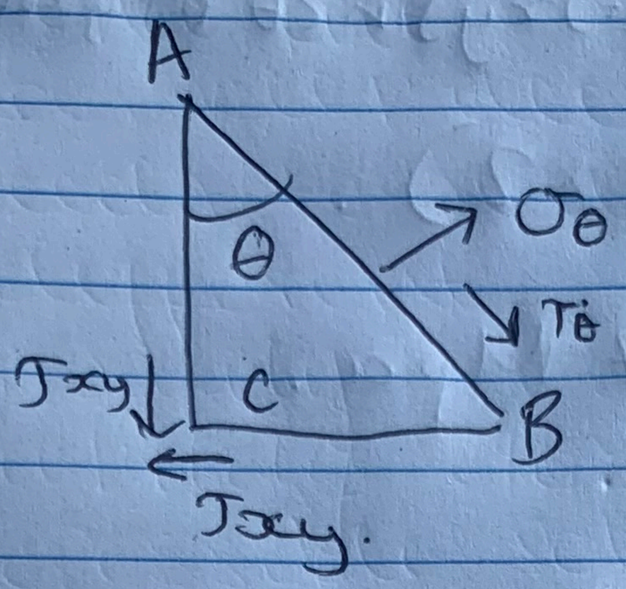
D is Analyse and select a solution. Once the solution has been decided it then needs to be analysed using different steps, of which include, safety, regulations, functionality etc. If there is more than one possible solution then each solution has to forego this analysis. Then a decision process is undertaken to choose the solution deemed most effective according to the analysis steps.

E is testing and implementing the Solution. This will include testing, constructing and manufacturing, ~~and~~ possibly further testing. There are multiple methods of implementing this task including applying for the correct copyright and patents, recording and documenting the process in order for easy recreation, and prototyping which occurs first. All that is included to complete the task of testing and implementing allows the product to be of a high quality whilst being low cost and possibly reaching the retail market sooner.

B) I think the ~~solution~~ step that could benefit from FEA is the testing & implementing the solution. Although each of the steps could use it. FEA is the process of taking the problem and splitting it into pieces which can be used to get a solution. It would benefit from FEA because the product / solution could be modelled and tested using the FEA process in order to determine the overall success or safety of the product.

Question 4

A)



$$AB\,\sigma_\theta = AC\,\tau_{xy}\sin\theta + BC\,\tau_{xy}\cos\theta$$

$$\sigma_\theta = \frac{AC}{AB}\tau_{xy}\sin\theta + \frac{BC}{AB}\tau_{xy}\cos\theta$$

Now, $\frac{AC}{AB} = \cos\theta$ and $\frac{BC}{AB} = \sin\theta$.

which means

$$\sigma_\theta = \tau_{xy}\sin\theta\cos\theta + \tau_{xy}\sin\theta\cos\theta$$

$$= 2\tau_{xy}\sin\theta\cos\theta$$

and $\sin\theta\cos\theta = \frac{1}{2}\sin 2\theta$

So

$$\sigma_\theta = \tau_{xy}\sin 2\theta.$$

B) Stress normal to the plane: $\sigma_\theta = \tau_{xy} \sin 2\theta$

$\sigma_\theta = 59 \sin 2(34 \times 2)$.

$= 54.7$ Mpa.

c) $\tau_\theta = -\tau_{xy} \cos 2\theta$.

$\tau_\theta = -59 \cos(2 \times 34)$.

~~$\tau_\theta = 22.1$ Mpa~~

$\tau_\theta = 22.1$ Mpa.

d). ~~a mountain hut~~ writing on a chalk board.

e). ~~Karan carpark Stacker out of wood and grass~~

~~Chalk~~ Chalk boards aren't used anymore, just laptops and tablets.