

Cae and stress analysis

Marcos Gonzalez Norris

1802722

M5X02064

1pm 07/05/2020

CAE and stress analysis

Question 1

a) Force of $\frac{1}{2}$ cylinder = $P \times \text{Projected area}$
 $= P \times dL$

Resistive forces = $2\sigma_H \times Lt$

$2\sigma_H \times Lt = Pd$

$\therefore \sigma_H = \frac{Pd}{2t}$ ✓

b) The longitudinal stresses are always ~~high~~ ^{high} of the hoop stresses $\therefore$ the largest stresses are always the hoop stresses ✓

c) 1.0270 g/cm^3

$\div 1000 \times 1000 = 1027 \text{ kg/m}^3$ ✓

~~1.0270 g/cm³ = 1027 kg/m³~~

d)

$$P = \cancel{1027} \quad 1027$$

$$g = 9.81$$

$$d = 2.8$$

$$t = 0.0028$$

$$\sigma_H = 195 \times 10^6$$

Factor of safety = 2

$$\frac{195 \times 10^6}{2} = 97.5 \times 10^6$$

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

$$\frac{97.5 \times 10^6 \times 2 \times 0.0028}{2.8} = 195000 \text{ pa}$$

$$P = \rho g h$$

$$h = \frac{P}{\rho g}$$

$$\frac{195000}{1027 \times 9.81}$$

$$= 19.355 \text{ m}$$

X

$$e) \quad P = 145000 + 0.1 \times 10^6 = \cancel{290000} \quad 295,000$$

$$\frac{295,000}{1027 \times 9.81} = \underline{29.28 \text{ m}}$$

ECF ✓

$$f) \quad 0.1 \times 2 \quad 0.2 \times 10^6 + 145000 = 395,000$$

$$\frac{395,000}{1027 \times 9.81} = \underline{39.2 \text{ m}}$$

ECF ✓

g) as the pressure increases inside the cabin there is a smaller pressure difference allowing the submarine to go deeper.

h) Submarine in a real life scenario is subject to more forces like currents and the motion of the vessel itself. Also the densities will change as temperature of the sea also change.

Question 2

a)

A Define the problem

- Identify a need for a product so that a customer will buy/use the product.

- Develop a problem statement where a broad definition is used so not to ignore other kinds of solution

- Establish a criteria for success so that engineers can form solutions that actually solve the problem

B GATHER relevant information

GATHERING information about the problem can reveal facts that are relevant to the solution.

ASKING questions about current solutions, economy, market value and important factors to take into account

Use multiple forms of sources to gather information to ensure it is reliable

C generate multiple solutions.

Starting with current solutions Break them down to see what was wrong with it. Then Brain storming and new solutions.

D Analyse and select appropriate solution

looking at the set of solutions you need to choose which is best based on certain factors

E.g.

- Function
- Economics
- Ergonomics
- Manufacturability etc.

E Test and implement the solution

Finally you need to test the solution and apply it to the market. Starting with prototyping to documenting everything clearly and finally applying for patents to avoid designs being copied.

b)

Gathering information, Analyzing and Testing
would all benefit from FEA.

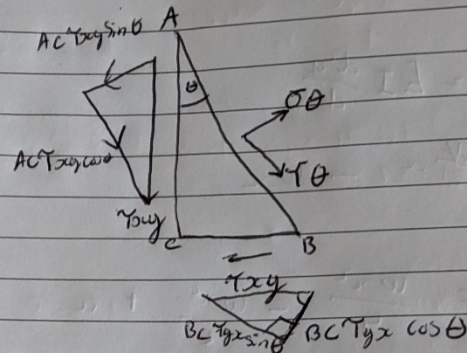
Using FEA you can gather information about behavioral characteristics in certain conditions.

You can use sur the analysis to show which solutions are most effective and efficient.

AND THEN FOR TESTING you can subject your design to many scenarios to see how it behaves.

Question 4.

a)



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

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

$$\frac{AC}{AB} = \cos \theta \quad \frac{BC}{AB} = \sin \theta$$

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

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

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

b) $\sigma_{\theta} = 62.7106 \times \sin(2 \times 37) = 59.598225.15$

$$59.598 \text{ MPa}$$

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

$-62 \times 10^6 \times \cos 2 \times 37 = -17089516.06$

-17.1 Mpa

d) a drive shaft within ~~a~~ car as it rotates.

e) in order for there to be shear stresses they have to be parallel to the plane. However it is almost impossible to have something exactly parallel with the plane.
 $\therefore$ very difficult for a only shear stress scenario.