

CAE and Stress analysis
(M5X02064)
Dion Billing (1701657)

2) a)

A - Defining the Problem. So finding what are the customer needs once the problem is defined. Then develop a problem statement to address the issues specifically and broader options. And then a criteria for success.

B - Gathering the relevant information. So this is down to how the relevant info is used and is it effective in solving the issues? Are there better or more economic options available? The customer price for the solution.

C - Generating Multiple Solutions. Using strategies such as Brainstorming or mind maps to get solutions. A synthesis of new solutions. Involving people from different areas of work. Take risks in design (Trial and error).

D - Analyse all options and select solution. Analysing factors such as: ergonomics, Economics, Reliability, Strength and function to find best solution.

E - Testing and implementation. This step is producing prototypes using 3D printing etc. to gather real data with real conditions. Then document of testing and then Patenting so the product is protected.

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b) So FEA could be used in the testing of the product. It could be used to reduce the number of prototypes used in testing as some test could be done virtually saving money and time.

CAE and Stress analysis

(M5 x 02064)

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1)

$$\begin{aligned} \text{a) } F_{UP} &= P \times A \\ &= P \times dL \end{aligned}$$

$$F_{Down} = 2\sigma_H \times tL$$

$$2\sigma_H \times tL = P \times dL$$

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

b) The longitudinal stress seen in the structures are double that seen in Spherical structures.

c) 1.0257 kg/m^3

UNIT

d) ~~$P = \rho gh$~~

~~g~~

$$P_{max} = \frac{2\sigma_H t}{d}$$

$$= \frac{2 \times 190 \times 10^6 \times 1.6 \times 10^{-3}}{1.6}$$

$$= 380000$$

$$= 380 \text{ kPa}$$

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4) a) $\sigma_\theta = \tau_{xy} \sin 2\theta$

$AB = 0$

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

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

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

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

b) $\theta = 25^\circ$ $\sigma_x = 50 \text{ MPa}$ $\sigma_y = -50$

$\sigma_\theta = \frac{1}{2} (50 - 50) + \frac{1}{2} (50 + 50) \cos 50 + 50 \sin 50$

$\sigma_\theta = 70.44 \text{ MPa}$

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

$= -50 \cos 50$

$= -32.14 \text{ MPa}$