STMS RECRUITMENT CHALLENGE

Solve as many questions as possible. Make assumptions wherever necessary. Judging criteria is not based on accuracy, but on approach. All the best!

A vertically stacked CubeSat avionics assembly consists of three PCBs (ADCS, COMMS, OBC), separated by **steel standoffs**, constrained by M3X8 screws, and surrounded by aluminium side rails. The PCBs have a mass of 24 gram each and are fixed only at their corners via four M3X8 screws. The standoffs are **hexagonal** (height=86mm) and adhered to the subsystem boards using adhesive.

1.On building the development model, it is found that one of the four steel standoffs has a cross-sectional area that is 10% smalle**r** due to machining tolerance. Assuming only one PCB to be present in the stack at that time, **(20)**

Tasks:

- Estimate the load on each standoff assuming stiffness-based distribution and linear elastic behaviour

- Determine the load amplification factor on the three standoffs compared to the ideal case

- Determine the bearing stress in the PCB at the standoff interface, and assess whether this exceeds allowable limits for FR4

2. The PCBs are mounted using M3 screws through clearance holes in the PCB (hole diameter = 3.2 mm; screw outer diameter = 3.0 mm). The screws are tightened manually; however standard fastening requirements were not followed.

During lateral vibration testing (Y-direction), a peak acceleration of 3g is recorded. **(20)**

Given:

-PCB mass = 24 g

-Lateral acceleration = 3g

-Screw outer diameter = 3.0 mm

-CB hole diameter = 3.2 mm

-Friction coefficient between PCB and stainless steel screw head = 0.3

Tasks:

(a) Estimate whether friction at the screw head at a corner of the PCB is sufficient to resist the maximum lateral force acting on it(assume vertical clamping force = 10 N per screw).

(b) Is there risk of slippage given the 0.2 mm radial clearance? Comment
(c) If you think there is still a risk of slippage, what can be done to counter it?

3. In a spacecraft thermal design, two blackbody surfaces are arranged perpendicularly with a shared edge of length 1.5 meters. **(10)**

- Surface A has a width of 2.5 m and is maintained at a temperature of 450 K.
- Surface B has a width of 3.5 m and is held at 350 K.
- Both surfaces are large flat plates and the edge connecting them is vertical. Assuming both surfaces are perfect black bodies and radiate only to each other, calculate the net radiative heat transfer from surface A to surface B.