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UAV DASL D1

Analysis of Deflection in Antenna

ME 495 Section 2 with Dr. Oman Tuesdays

Deflection is a serious design consideration. It is particularly pertinent to the UAV DASL project as it is our main goal to move an antenna to a given orientation and then report that orientation back to the user. If the team did not account for deflections in the system it is possible that the reported angles would be inaccurate and potentially inconsistent.

There will be several assumptions in the deflection calculations:

1. All load is evenly distributed across the main antenna member.
2. There is a point load where the support is on the antenna exactly halfway down the length of the antenna.
3. The mount of the antenna is perfectly rigid.
4. The antenna is perfectly symmetrical and one half of the antenna can be used to approximate both sides.

Figure 1 below shows how the loading will be assumed.

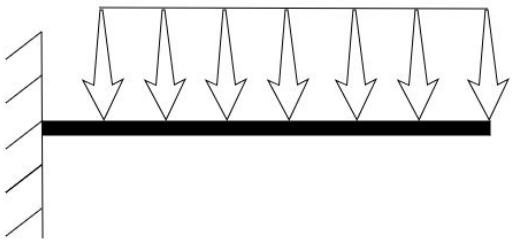

Figure 1. Loading Diagram

The equations used for the deflection calculations are:

$$\theta = -\frac{wX^3}{6EI} \quad (1)$$

$$\delta = \frac{wl^4}{8EI} \quad (2)$$

Where θ is the angle of rotation from the x-axis, w is the distributed load, X is the distance in the x-direction, δ is the deflection, and l is the length of the beam.

Using equation 2 it was found that the maximum deflection from an aluminum rod with a circular cross section will be about .000855 inches. This deflection is so small that it is negligible. This is the deflection of one side of the antenna while it is cantilevered. The maximum angle of rotation occurs at the end of the antenna and it has been calculated to be -.0001815 degrees down from the x-axis. This is also negligible as it will almost certainly be greater than the accuracy of our servo motor, so the team could not account for this inaccuracy with the motor. Luckily the with the current design deflection is minimized and will not affect our ability to accurately readout data.