EAS4200C Aerospace Structures Project #1 (Due: Nov. 11th)

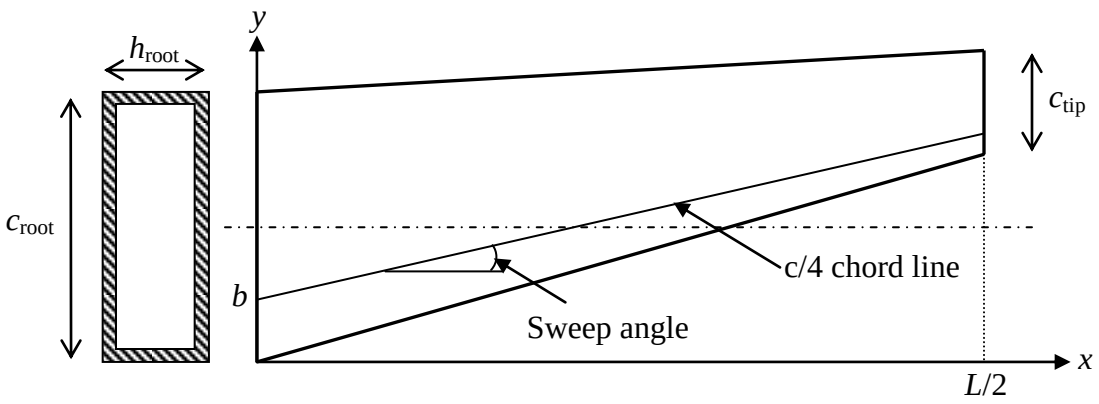
Project must be performed individually and submitted online in MS/Word or PDF format. The file name should be Project1_sortingnumber.doc (or pdf). For example, if your sorting number is 9, the file name should be Project1_09.doc or Project1_09.pdf. Your report must explain step-by-step procedure in detail. Use equations, figures, and tables as necessary.

The objective of this project is to estimate stresses at the root of a wing and determine the safety of the wing using failure criteria.

- The cross section of the wing is assumed to be made of thin hollow rectangular box section and the platform is trapezoidal. The wing is modeled as a cantilever beam clamped at its middle section and free at its ends.
- The lift, *w*, over the surface of the entire wing is replaced by a line load (lift per unit length) elliptically distributed along a sweep of a line whose locus of pointes are one-quarter of the chord from leading edge (c/4 line) at angle of 30 degree.

1. Formulate an expression for lift *w* as a function of the span location *x*. The total lift is the weight of the plane times the load factor 2.5. Plot the lift *w* over the half-span of the wing: $x = [0, L/2]$. Explain your formulation.

2. Derive the relationship for the transverse shear force *V*, bending moment *M* as a function of span location *x*. Calculate the transverse shear force *V*, bending moment *M* and torque *T* at the wing root section. Calculate the maximum von Mises stress at the root and compare it with yield strength of the material. Assume the wing is made of Aluminum 7075-T6.



Weight of the plane	350,000lb	Wing span *L*	1,858in
Root width c_{root}	251.6in	Root height h_{root}	49in
Thickness of plate *t*	1.0in	Load factor	2.5