

ASEN 3128 Assignment 6

Due: Thursday, March 5 at 11:59 PM on Canvas

- 1) Show that a positively cambered wing cannot be statically stable as a flying wing (i.e. without empennage) for any c.g. location.
- 2) Consider a rectangular flying wing with a $C_{m_{ac_w}}$ of 0.02 about the quarter-chord, a lift curve slope of 0.1/deg, a C_{L_w} at zero angle of attack of 0, a span of 10m, and a chord of 1.0 [m].
 - a. Where should the c.g. be placed relative to the leading edge to produce a static margin of 0.05?
 - b. What is the resulting pitch stiffness?
 - c. What is the trimmed angle of attack?
 - d. If the vehicle weighs 100 kg, what is the airspeed needed to fly at sea level? At Boulder?
 - e. What is the chord Reynolds number for sea level flight? Boulder flight?
 - f. If L/D at the trimmed angle of attack is 10, how much power is required to fly?
 - g. What is the pitch stiffness about the trimmed angle of attack in units of Nm/deg?
 - h. What is the relationship between pitch stiffness (in Nm/deg) and angle of attack for variation in c.g. location? Can c.g. movement be an effective control for angle of attack?
 - i. Design a tail for this wing that provides the same static margin as before, but with the c.g. at the quarter-chord of the wing. Assume the same lift curve slope for the tail airfoil as for the wing.
 - j. Would it difficult to triple the pitch stiffness with a modification of this tail design?