MAE 159 : Aircraft Design

Wing and Tail Sizing General Procedure

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Dimensions from Preliminary Sizing (Code) :
Span
S
AR
Sweep Angle
Taper Ratio (From code or use typ. Values)

The following is a general guide on how to size wings and tails for general aviation transports. Modify as necessary depending on your given information.

Wing Sizing:

1) Use Schaufele Eq. 4-17 to calculate C_Root and Eq. 4-18 for C_Tip.
2) Calculate MAC (Eq. 4-19) and its Spanwise Location (Y-Bar) using Eq. 4-20.
3) Draw wing according to example wing-tail diagram provided and in Schaufele. As a reminder:
    a. Sweep angle should pass through quarter chord (C_1/4) at all locations.
    b. Aircraft CG location should be about C_MAC_1/4
    c. Depending on sweep, this location may be "off the airfoil"
    d. "b" is the total span of aircraft, not *halfspan*

Tail Sizing:

1) Choose tail arm (Distance from C_MAC_1/4 Wing to C_MAC_1/4 Tail.)
    a. Good starting values are between 25% to 40% half span, depending on engine configuration.
    b. Tail arm will be assume to be the same form V_h and V_v
2) **Horizontal Tail:**
    a. Use Eq. 6-3 to calculate horizontal reference tail area (S_H) from Volume coefficients:
        i. Use typical V_h values for "Jet Transports" Fig 6-9.
    b. Use Fig 6-17 to choose typical values of the following:
        i. AR
        ii. Taper Ratio
        iii. Sweep (~5 deg more than wing)
    c. Use the wing sizing equations to calculate the following for the Horizontal Tail:
        i. C_Root & C_Tip
        ii. MAC & Y-Bar
    d. Draw wing according to example wing-tail diagram provided and in Schaufele
3) **Vertical Tail:**
    a. Use Eq. 6-4 to calculate vertical reference tail area (S_v) from Volume coefficients:

    i. Use typical V_v values for “Jet Transports” Fig 6-16.
b. Use Fig 6-18 to choose typical values of the following:
    i. AR
    ii. Taper Ratio
    iii. Sweep (~5 deg more than wing)
c. Use the wing sizing equations to calculate the following for the Vertical Tail:
    i. C_Root & C_Tip
    ii. MAC & Y-Bar
d. Draw wing according to example wing-tail diagram provided and in Schaufele.