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Tail Contribution Formulas

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List of 19 Tail Contribution Formulas

Tail Contribution

1) Horizontal tail area for given tail volume ratio

Open Calculator

fx $$S_t = V_H \cdot S \cdot \frac{c_{ma}}{l_t}$$

ex $$1.8\text{m}^2 = 1.42 \cdot 5.08\text{m}^2 \cdot \frac{0.2\text{m}}{0.801511\text{m}}$$

2) Horizontal tail volume ratio

Open Calculator

fx $$V_H = l_t \cdot \frac{S_t}{S \cdot c_{ma}}$$

ex $$1.42 = 0.801511\text{m} \cdot \frac{1.8\text{m}^2}{5.08\text{m}^2 \cdot 0.2\text{m}}$$

3) Horizontal Tail Volume Ratio for given Pitching Moment Coefficient

Open Calculator

fx $$V_H = -\left(\frac{Cm_t}{\eta \cdot CT_{lift}}\right)$$

ex $$1.413043 = -\left(\frac{-0.39}{0.92 \cdot 0.3}\right)$$

4) Mean Aerodynamic Chord for given Tail Pitching Moment Coefficient

Open Calculator

$$c_{ma} = \frac{M_t}{0.5 \cdot \rho_\infty \cdot V^2 \cdot S \cdot Cm_t}$$

$$0.200217\text{m} = \frac{-218.6644\text{N*m}}{0.5 \cdot 1.225\text{kg/m}^3 \cdot (30\text{m/s})^2 \cdot 5.08\text{m}^2 \cdot -0.39}$$

5) Pitching Moment due to Tail

Open Calculator

$$M_t = -l_t \cdot L_t$$

$$-218.844563\text{N*m} = -0.801511\text{m} \cdot 273.04\text{N}$$

6) Tail Area for given Tail Moment Coefficient

Open Calculator

$$S_t = -\frac{Cm_t \cdot S \cdot c_{ma}}{\eta \cdot l_t \cdot CT_{lift}}$$

$$1.791182\text{m}^2 = -\frac{-0.39 \cdot 5.08\text{m}^2 \cdot 0.2\text{m}}{0.92 \cdot 0.801511\text{m} \cdot 0.3}$$

7) Tail Efficiency for given Pitching Moment Coefficient

Open Calculator

$$\eta = -\frac{Cm_t \cdot S \cdot c_{ma}}{l_t \cdot S_t \cdot CT_{lift}}$$

$$0.915493 = -\frac{-0.39 \cdot 5.08\text{m}^2 \cdot 0.2\text{m}}{0.801511\text{m} \cdot 1.8\text{m}^2 \cdot 0.3}$$

8) Tail Efficiency for given Tail Volume Ratio

Open Calculator

$$\eta = -\left(\frac{Cm_t}{V_H \cdot CT_{lift}}\right)$$

$$0.915493 = -\left(\frac{-0.39}{1.42 \cdot 0.3}\right)$$

9) Tail Lift Coefficient for given Tail Volume Ratio

Open Calculator

$$CT_{lift} = -\left(\frac{Cm_t}{V_H \cdot \eta}\right)$$

$$0.29853 = -\left(\frac{-0.39}{1.42 \cdot 0.92}\right)$$

10) Tail Lift for given Tail Pitching Moment

Open Calculator

$$L_t = -\left(\frac{M_t}{l_t}\right)$$

$$272.8152\text{N} = -\left(\frac{-218.6644\text{N*m}}{0.801511\text{m}}\right)$$

11) Tail moment arm for given horizontal tail volume ratio

Open Calculator

$$l_t = V_H \cdot S \cdot \frac{c_{ma}}{S_t}$$

$$0.801511\text{m} = 1.42 \cdot 5.08\text{m}^2 \cdot \frac{0.2\text{m}}{1.8\text{m}^2}$$

12) Tail Moment Arm for given Tail Moment Coefficient

Open Calculator

$$l_t = -\frac{Cm_t \cdot S \cdot c_{ma}}{\eta \cdot S_t \cdot CT_{lift}}$$

$$0.797585\text{m} = -\frac{-0.39 \cdot 5.08\text{m}^2 \cdot 0.2\text{m}}{0.92 \cdot 1.8\text{m}^2 \cdot 0.3}$$

13) Tail Pitching Moment Coefficient

Open Calculator

$$Cm_t = \frac{M_t}{0.5 \cdot \rho_\infty \cdot V^2 \cdot S \cdot c_{ma}}$$

$$-0.390423 = \frac{-218.6644\text{N*m}}{0.5 \cdot 1.225\text{kg/m}^3 \cdot (30\text{m/s})^2 \cdot 5.08\text{m}^2 \cdot 0.2\text{m}}$$

14) Tail Pitching Moment Coefficient for given Tail Efficiency

Open Calculator

$$Cm_t = -\frac{\eta \cdot S_t \cdot l_t \cdot CT_{lift}}{S \cdot c_{ma}}$$

$$-0.39192 = -\frac{0.92 \cdot 1.8\text{m}^2 \cdot 0.801511\text{m} \cdot 0.3}{5.08\text{m}^2 \cdot 0.2\text{m}}$$

15) Tail Pitching Moment Coefficient for given Tail Volume Ratio

Open Calculator

$$Cm_t = -V_H \cdot \eta \cdot CT_{lift}$$

$$-0.39192 = -1.42 \cdot 0.92 \cdot 0.3$$

16) Tail Pitching Moment for given Lift Coefficient

Open Calculator

$$M_t = -\frac{l_t \cdot CT_{lift} \cdot \rho_\infty \cdot V_{tail}^2 \cdot S_t}{2}$$

ex

$$-218.664465\text{N*m} = -\frac{0.801511\text{m} \cdot 0.3 \cdot 1.225\text{kg/m}^3 \cdot (28.72\text{m/s})^2 \cdot 1.8\text{m}^2}{2}$$

17) Tail Pitching Moment for given Moment Coefficient

Open Calculator

$$M_t = \frac{Cm_t \cdot \rho_\infty \cdot V^2 \cdot S \cdot c_{ma}}{2}$$

ex

$$-218.4273\text{N*m} = \frac{-0.39 \cdot 1.225\text{kg/m}^3 \cdot (30\text{m/s})^2 \cdot 5.08\text{m}^2 \cdot 0.2\text{m}}{2}$$

18) Wing Mean Aerodynamic Chord for given Horizontal Tail Volume Ratio

Open Calculator

$$c_{ma} = l_t \cdot \frac{S_t}{S \cdot V_H}$$

ex

$$0.2\text{m} = 0.801511\text{m} \cdot \frac{1.8\text{m}^2}{5.08\text{m}^2 \cdot 1.42}$$

19) Wing Reference Area for given Horizontal Tail Volume Ratio

Open Calculator

fx $$S = l_t \cdot \frac{S_t}{V_H \cdot c_{ma}}$$

ex $$5.079999\text{m}^2 = 0.801511\text{m} \cdot \frac{1.8\text{m}^2}{1.42 \cdot 0.2\text{m}}$$

Variables Used

- c_{ma} Mean Aerodynamic Chord *(Meter)*
- Cm_t Tail Pitching Moment Coefficient
- CT_{lift} Tail Lift Coefficient
- L_t Lift due to Tail *(Newton)*
- M_t Pitching Moment due to Tail *(Newton Meter)*
- S Reference Area *(Square Meter)*
- S_t Horizontal Tail Area *(Square Meter)*
- V Flight Velocity *(Meter per Second)*
- V_H Horizontal Tail Volume Ratio
- V_{tail} Velocity Tail *(Meter per Second)*
- η Tail Efficiency
- ρ_∞ Freestream Density *(Kilogram per Cubic Meter)*
- l_t Horizontal Tail Moment Arm *(Meter)*

Constants, Functions, Measurements used

- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Area** in Square Meter (m²)
  Area Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Force** in Newton (N)
  Force Unit Conversion
- Measurement: **Density** in Kilogram per Cubic Meter (kg/m³)
  Density Unit Conversion
- Measurement: **Moment of Force** in Newton Meter (N*m)
  Moment of Force Unit Conversion

Check other formula lists

- **Tail Contribution Formulas**

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