

Important Tail Contribution Formulas PDF



Formulas Examples with Units

List of 19 Important Tail Contribution Formulas

1) Horizontal tail area for given tail volume ratio Formula ↻

Formula

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

Example with Units

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

Evaluate Formula ↻

2) Horizontal tail volume ratio Formula ↻

Formula

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

Example with Units

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

Evaluate Formula ↻

3) Horizontal Tail Volume Ratio for given Pitching Moment Coefficient Formula ↻

Formula

$$V_H = - \left(\frac{C_{m_t}}{\eta \cdot C_{T_{\text{lift}}}} \right)$$

Example

$$1.413 = - \left(\frac{-0.39}{0.92 \cdot 0.3} \right)$$

Evaluate Formula ↻

4) Mean Aerodynamic Chord for given Tail Pitching Moment Coefficient Formula ↻

Formula

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

Example with Units

$$0.2002 \text{ m} = \frac{-218.6644 \text{ N}^* \text{ m}}{0.5 \cdot 1.225 \text{ kg/m}^3 \cdot 30 \text{ m/s}^2 \cdot 5.08 \text{ m}^2 \cdot -0.39}$$

Evaluate Formula ↻

5) Pitching Moment due to Tail Formula ↻

Formula

$$M_t = - l_t \cdot L_t$$

Example with Units

$$-218.8446 \text{ N}^* \text{ m} = - 0.801511 \text{ m} \cdot 273.04 \text{ N}$$

Evaluate Formula ↻

6) Tail Area for given Tail Moment Coefficient Formula ↻

Formula

$$S_t = - \frac{C_{m_t} \cdot S \cdot c_{ma}}{\eta \cdot l_t \cdot C_{T_{\text{lift}}}}$$

Example with Units

$$1.7912 \text{ m}^2 = - \frac{-0.39 \cdot 5.08 \text{ m}^2 \cdot 0.2 \text{ m}}{0.92 \cdot 0.801511 \text{ m} \cdot 0.3}$$

Evaluate Formula ↻



7) Tail Efficiency for given Pitching Moment Coefficient Formula

Formula

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

Example with Units

$$0.9155 = - \frac{-0.39 \cdot 5.08 \text{ m}^2 \cdot 0.2 \text{ m}}{0.801511 \text{ m} \cdot 1.8 \text{ m}^2 \cdot 0.3}$$

Evaluate Formula 

8) Tail Efficiency for given Tail Volume Ratio Formula

Formula

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

Example

$$0.9155 = - \left(\frac{-0.39}{1.42 \cdot 0.3} \right)$$

Evaluate Formula 

9) Tail Lift Coefficient for given Tail Volume Ratio Formula

Formula

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

Example

$$0.2985 = - \left(\frac{-0.39}{1.42 \cdot 0.92} \right)$$

Evaluate Formula 

10) Tail Lift for given Tail Pitching Moment Formula

Formula

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

Example with Units

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

Evaluate Formula 

11) Tail moment arm for given horizontal tail volume ratio Formula

Formula

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

Example with Units

$$0.8015 \text{ m} = 1.42 \cdot 5.08 \text{ m}^2 \cdot \frac{0.2 \text{ m}}{1.8 \text{ m}^2}$$

Evaluate Formula 

12) Tail Moment Arm for given Tail Moment Coefficient Formula

Formula

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

Example with Units

$$0.7976 \text{ m} = - \frac{-0.39 \cdot 5.08 \text{ m}^2 \cdot 0.2 \text{ m}}{0.92 \cdot 1.8 \text{ m}^2 \cdot 0.3}$$

Evaluate Formula 

13) Tail Pitching Moment Coefficient Formula

Formula

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

Example with Units

$$-0.3904 = \frac{-218.6644 \text{ N} \cdot \text{m}}{0.5 \cdot 1.225 \text{ kg/m}^3 \cdot 30 \text{ m/s}^2 \cdot 5.08 \text{ m}^2 \cdot 0.2 \text{ m}}$$

Evaluate Formula 



14) Tail Pitching Moment Coefficient for given Tail Efficiency Formula

Formula

$$C_{m_t} = - \frac{\eta \cdot S_t \cdot l_t \cdot C_{T_{\text{lift}}}}{S \cdot c_{ma}}$$

Example with Units

$$-0.3919 = - \frac{0.92 \cdot 1.8 \text{ m}^2 \cdot 0.801511 \text{ m} \cdot 0.3}{5.08 \text{ m}^2 \cdot 0.2 \text{ m}}$$

Evaluate Formula 

15) Tail Pitching Moment Coefficient for given Tail Volume Ratio Formula

Formula

$$C_{m_t} = - V_H \cdot \eta \cdot C_{T_{\text{lift}}}$$

Example

$$-0.3919 = - 1.42 \cdot 0.92 \cdot 0.3$$

Evaluate Formula 

16) Tail Pitching Moment for given Lift Coefficient Formula

Formula

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

Example with Units

$$-218.6645 \text{ N}\cdot\text{m} = - \frac{0.801511 \text{ m} \cdot 0.3 \cdot 1.225 \text{ kg/m}^3 \cdot 28.72 \text{ m/s}^2 \cdot 1.8 \text{ m}^2}{2}$$

Evaluate Formula 

17) Tail Pitching Moment for given Moment Coefficient Formula

Formula

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

Example with Units

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

Evaluate Formula 

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

Formula

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

Example with Units

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

Evaluate Formula 

19) Wing Reference Area for given Horizontal Tail Volume Ratio Formula

Formula

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

Example with Units

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

Evaluate Formula 



Variables used in list of Tail Contribution Formulas above

- C_{ma} Mean Aerodynamic Chord (Meter)
- C_{m_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 in list of Tail Contribution Formulas above

- **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 



Download other Important Longitudinal Stability PDFs

- **Important Tail Contribution Formulas** 
- **Important Wing-Tail Contribution Formulas** 

Try our Unique Visual Calculators

-  **Percentage increase** 
-  **HCF calculator** 
-  **Mixed fraction** 

Please SHARE this PDF with someone who needs it!

This PDF can be downloaded in these languages

[English](#) [Spanish](#) [French](#) [German](#) [Russian](#) [Italian](#) [Portuguese](#) [Polish](#) [Dutch](#)

7/8/2024 | 8:09:53 AM UTC

