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Wing-Tail Interaction Formulas

Calculators! Examples! Conversions!

List of 12 Wing-Tail Interaction Formulas

Wing-Tail Interaction

1) Dynamic Pressure at Vertical Tail for given Vertical Tail Efficiency

Open Calculator

fx $$Q_v = \eta_v \cdot Q_w$$

ex $$10.9956\text{Pa} = 16.66 \cdot 0.66\text{Pa}$$

2) Dynamic Pressure at Vertical Tail for given Yawing Moment Coefficient

Open Calculator

fx $$Q_v = C_n \cdot S \cdot b \cdot \frac{Q_w}{l_v \cdot S_v \cdot C_v \cdot (\beta + \sigma)}$$

ex $$10.98496\text{Pa} = 1.4 \cdot 5.08\text{m}^2 \cdot 1.15\text{m} \cdot \frac{0.66\text{Pa}}{1.2\text{m} \cdot 5\text{m}^2 \cdot 0.7\text{rad}^{-1} \cdot (0.05\text{rad} + 0.067\text{rad})}$$

3) Dynamic Pressure at Wing for given Vertical Tail Efficiency

Open Calculator

fx $$Q_w = \frac{Q_v}{\eta_v}$$

ex $$0.660264\text{Pa} = \frac{11\text{Pa}}{16.66}$$

4) Dynamic Pressure at Wing for given Yawing Moment Coefficient

Open Calculator

fx $$Q_w = l_v \cdot S_v \cdot Q_v \cdot C_v \cdot \frac{\beta + \sigma}{S \cdot b \cdot C_n}$$

ex $$0.660904\text{Pa} = 1.2\text{m} \cdot 5\text{m}^2 \cdot 11\text{Pa} \cdot 0.7\text{rad}^{-1} \cdot \frac{0.05\text{rad} + 0.067\text{rad}}{5.08\text{m}^2 \cdot 1.15\text{m} \cdot 1.4}$$

5) Vertical Tail Dynamic Pressure for given Moment

Open Calculator

fx $$Q_v = \frac{N_v}{l_v \cdot C_v \cdot (\beta + \sigma) \cdot S_v}$$

ex $$10.98901\text{Pa} = \frac{5.4\text{N*m}}{1.2\text{m} \cdot 0.7\text{rad}^{-1} \cdot (0.05\text{rad} + 0.067\text{rad}) \cdot 5\text{m}^2}$$

6) Wing Area for given Moment Produced by Vertical Tail

Open Calculator

fx $$S = \frac{N_v}{C_n \cdot Q_w \cdot b}$$

ex $$5.081875\text{m}^2 = \frac{5.4\text{N*m}}{1.4 \cdot 0.66\text{Pa} \cdot 1.15\text{m}}$$

7) Wing Area for given Vertical Tail Volume Ratio

Open Calculator

fx $$S = l_v \cdot \frac{S_v}{b \cdot V_v}$$

ex $$5.11509\text{m}^2 = 1.2\text{m} \cdot \frac{5\text{m}^2}{1.15\text{m} \cdot 1.02}$$

8) Wing Area for given Yawing Moment Coefficient

Open Calculator

fx $$S = l_v \cdot S_v \cdot Q_v \cdot C_v \cdot \frac{\beta + \sigma}{C_n \cdot b \cdot Q_w}$$

ex $$5.086957\text{m}^2 = 1.2\text{m} \cdot 5\text{m}^2 \cdot 11\text{Pa} \cdot 0.7\text{rad}^{-1} \cdot \frac{0.05\text{rad} + 0.067\text{rad}}{1.4 \cdot 1.15\text{m} \cdot 0.66\text{Pa}}$$

9) Wing Dynamic Pressure for given Yawing Moment Coefficient

Open Calculator

fx $$Q_w = \frac{N_v}{C_n \cdot S \cdot b}$$

ex $$0.660244\text{Pa} = \frac{5.4\text{N*m}}{1.4 \cdot 5.08\text{m}^2 \cdot 1.15\text{m}}$$

10) Wingspan for given Vertical Tail Volume Ratio

Open Calculator

fx $$b = \boldsymbol{l}_v \cdot \frac{S_v}{S \cdot V_v}$$

ex $$1.157943\text{m} = 1.2\text{m} \cdot \frac{5\text{m}^2}{5.08\text{m}^2 \cdot 1.02}$$

11) Wingspan for given Yawing Moment Coefficient

Open Calculator

fx $$b = \frac{N_v}{C_n \cdot S \cdot Q_w}$$

ex $$1.150424\text{m} = \frac{5.4\text{N*m}}{1.4 \cdot 5.08\text{m}^2 \cdot 0.66\text{Pa}}$$

12) Wingspan for Yawing Moment Coefficient given Sideslip Angle and Sidewash Angle

Open Calculator

fx $$b = \boldsymbol{l}_v \cdot S_v \cdot Q_v \cdot C_v \cdot \frac{\beta + \sigma}{S \cdot C_n \cdot Q_w}$$

ex $$1.151575\text{m} = 1.2\text{m} \cdot 5\text{m}^2 \cdot 11\text{Pa} \cdot 0.7\text{rad}^{-1} \cdot \frac{0.05\text{rad} + 0.067\text{rad}}{5.08\text{m}^2 \cdot 1.4 \cdot 0.66\text{Pa}}$$

Variables Used

- **b** Wingspan *(Meter)*
- **C_n** Yawing Moment Coefficient
- **C_v** Vertical Tail Lift Curve Slope *(1 per Radian)*
- **N_v** Vertical Tail Moment *(Newton Meter)*
- **Q_v** Vertical Tail Dynamic Pressure *(Pascal)*
- **Q_w** Wing Dynamic Pressure *(Pascal)*
- **S** Reference Area *(Square Meter)*
- **S_v** Vertical Tail Area *(Square Meter)*
- **V_v** Vertical Tail Volume Ratio
- **β** Sideslip Angle *(Radian)*
- **η_v** Vertical Tail Efficiency
- **σ** Sidewash Angle *(Radian)*
- **$\mathcal{l}_v$** Vertical Tail Moment Arm *(Meter)*

Constants, Functions, Measurements used

- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Area** in Square Meter (m^2)
  Area Unit Conversion
- Measurement: **Pressure** in Pascal (Pa)
  Pressure Unit Conversion
- Measurement: **Angle** in Radian (rad)
  Angle Unit Conversion
- Measurement: **Moment of Force** in Newton Meter (N*m)
  Moment of Force Unit Conversion
- Measurement: **Reciprocal Angle** in 1 per Radian (rad^{-1})
  Reciprocal Angle Unit Conversion

Check other formula lists

- **Aerodynamic Parameters Formulas**
- **Vertical Tail Contribution Formulas**
- **Wing-Tail Interaction Formulas**

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