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# Stick Forces and Hinge Moments Formulas

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# List of 23 Stick Forces and Hinge Moments Formulas

## Stick Forces and Hinge Moments

### 1) Control stick length for given gearing ratio

$$fx \quad l_s = \frac{\delta_e}{G \cdot \delta_s}$$

[Open Calculator !\[\]\(a870788d6ed9b8fd294b7654a8c8526b\_img.jpg\)](#)

$$ex \quad 0.215m = \frac{0.1rad}{0.930233m^{-1} \cdot 0.5rad}$$

### 2) Elevator Area given Hinge Moment Coefficient

$$fx \quad S_e = \frac{H_e}{Ch_e \cdot 0.5 \cdot \rho \cdot V^2 \cdot c_e}$$

[Open Calculator !\[\]\(c50c8b7b2cc2cf9ff925edec0ee94c0d\_img.jpg\)](#)

$$ex \quad 0.024529m^2 = \frac{25N \cdot m}{0.770358 \cdot 0.5 \cdot 1.225kg/m^3 \cdot (60m/s)^2 \cdot 0.6m}$$

### 3) Elevator Area given Stick Force

$$fx \quad S_e = \frac{F}{G \cdot Ch_e \cdot 0.5 \cdot \rho \cdot V^2 \cdot c_e}$$

[Open Calculator !\[\]\(f60b7a900783ac3fd531bfd9c111be6d\_img.jpg\)](#)

$$ex \quad 0.024529m^2 = \frac{23.25581N}{0.930233m^{-1} \cdot 0.770358 \cdot 0.5 \cdot 1.225kg/m^3 \cdot (60m/s)^2 \cdot 0.6m}$$



4) Elevator Chord Length given Hinge Moment Coefficient 

$$fx \quad c_e = \frac{H_e}{Ch_e \cdot 0.5 \cdot \rho \cdot V^2 \cdot S_e}$$

Open Calculator 

$$ex \quad 0.599742m = \frac{25N^*m}{0.770358 \cdot 0.5 \cdot 1.225kg/m^3 \cdot (60m/s)^2 \cdot 0.02454m^2}$$

5) Elevator Chord Length given Stick Force 

$$fx \quad c_e = \frac{F}{G \cdot Ch_e \cdot 0.5 \cdot \rho \cdot V^2 \cdot S_e}$$

Open Calculator 

$$ex \quad 0.599741m = \frac{23.25581N}{0.930233m^{-1} \cdot 0.770358 \cdot 0.5 \cdot 1.225kg/m^3 \cdot (60m/s)^2 \cdot 0.02454m^2}$$

6) Elevator Deflection Angle for given Stick Force 

$$fx \quad \delta_e = F \cdot l_s \cdot \frac{\delta_s}{H_e}$$

Open Calculator 

$$ex \quad 0.1rad = 23.25581N \cdot 0.215m \cdot \frac{0.5rad}{25N^*m}$$

7) Elevator Deflection Angle given Gearing Ratio 

$$fx \quad \delta_e = G \cdot l_s \cdot \delta_s$$

Open Calculator 

$$ex \quad 0.1rad = 0.930233m^{-1} \cdot 0.215m \cdot 0.5rad$$



8) Elevator Hinge moment coefficient 

$$f_x \quad Ch_e = \frac{H_e}{0.5 \cdot \rho \cdot V^2 \cdot S_e \cdot c_e}$$

[Open Calculator !\[\]\(e78f798d4ea5c530c9db49e7d26e6b95\_img.jpg\)](#)

$$ex \quad 0.770026 = \frac{25N \cdot m}{0.5 \cdot 1.225kg/m^3 \cdot (60m/s)^2 \cdot 0.02454m^2 \cdot 0.6m}$$

9) Elevator Hinge Moment given Hinge Moment Coefficient 

$$f_x \quad H_e = Ch_e \cdot 0.5 \cdot \rho \cdot V^2 \cdot S_e \cdot c_e$$

[Open Calculator !\[\]\(05be7c7a8995decd503647c99211f7c2\_img.jpg\)](#)

$$ex \quad 25.01077N \cdot m = 0.770358 \cdot 0.5 \cdot 1.225kg/m^3 \cdot (60m/s)^2 \cdot 0.02454m^2 \cdot 0.6m$$

10) Elevator Stick Force 

$$f_x \quad F = \delta_e \cdot \frac{H_e}{l_s \cdot \delta_s}$$

[Open Calculator !\[\]\(fe3aebe81acea8d45108cd2768939da7\_img.jpg\)](#)

$$ex \quad 23.25581N = 0.1rad \cdot \frac{25N \cdot m}{0.215m \cdot 0.5rad}$$

11) Elevator Stick Force given Gearing Ratio 

$$f_x \quad F = G \cdot H_e$$

[Open Calculator !\[\]\(899d8b7697d64725bf017d3296cfcf1b\_img.jpg\)](#)

$$ex \quad 23.25582N = 0.930233m^{-1} \cdot 25N \cdot m$$

12) Elevator Stick Force given Hinge Moment Coefficient 

$$f_x \quad F = G \cdot Ch_e \cdot 0.5 \cdot \rho \cdot V^2 \cdot c_e \cdot S_e$$

[Open Calculator !\[\]\(40770d9ed6ed4f1222ebf89a1396e8b2\_img.jpg\)](#)

$$ex \quad 23.26584N = 0.930233m^{-1} \cdot 0.770358 \cdot 0.5 \cdot 1.225kg/m^3 \cdot (60m/s)^2 \cdot 0.6m \cdot 0.02454m^2$$



13) Flight Velocity for given Stick Force [Open Calculator !\[\]\(bd1a142de767a21e5362c595f844a4ff\_img.jpg\)](#)

$$fx \quad V = \sqrt{\frac{F}{G \cdot C_{h_e} \cdot 0.5 \cdot \rho \cdot S_e \cdot c_e}}$$

$$ex \quad 59.98707 \text{m/s} = \sqrt{\frac{23.25581 \text{N}}{0.930233 \text{m}^{-1} \cdot 0.770358 \cdot 0.5 \cdot 1.225 \text{kg/m}^3 \cdot 0.02454 \text{m}^2 \cdot 0.6 \text{m}}}$$

14) Flight Velocity given Elevator Hinge Moment Coefficient [Open Calculator !\[\]\(830769b31eeeaca920791081939ff8ba\_img.jpg\)](#)

$$fx \quad V = \sqrt{\frac{H_e}{C_{h_e} \cdot 0.5 \cdot \rho \cdot S_e \cdot c_e}}$$

$$ex \quad 59.98708 \text{m/s} = \sqrt{\frac{25 \text{N}^* \text{m}}{0.770358 \cdot 0.5 \cdot 1.225 \text{kg/m}^3 \cdot 0.02454 \text{m}^2 \cdot 0.6 \text{m}}}$$

15) Gearing Ratio [Open Calculator !\[\]\(47734e4656765d20df4fdbd5b7aff048\_img.jpg\)](#)

$$fx \quad G = \frac{\delta_e}{l_s \cdot \delta_s}$$

$$ex \quad 0.930233 \text{m}^{-1} = \frac{0.1 \text{rad}}{0.215 \text{m} \cdot 0.5 \text{rad}}$$

16) Gearing Ratio for given Stick Force [Open Calculator !\[\]\(41aea2746216b27a6939d696d8e035da\_img.jpg\)](#)

$$fx \quad G = \frac{F}{H_e}$$

$$ex \quad 0.930232 \text{m}^{-1} = \frac{23.25581 \text{N}}{25 \text{N}^* \text{m}}$$



17) Gearing Ratio given Hinge Moment Coefficient 

$$fx \quad G = \frac{F}{Ch_e \cdot 0.5 \cdot \rho \cdot V^2 \cdot S_e \cdot c_e}$$

Open Calculator 

$$ex \quad 0.929832m^{-1} = \frac{23.25581N}{0.770358 \cdot 0.5 \cdot 1.225kg/m^3 \cdot (60m/s)^2 \cdot 0.02454m^2 \cdot 0.6m}$$

18) Hinge Moment Coefficient given Stick Force 

$$fx \quad Ch_e = \frac{F}{G \cdot 0.5 \cdot \rho \cdot V^2 \cdot c_e \cdot S_e}$$

Open Calculator 

$$ex \quad 0.770026 = \frac{23.25581N}{0.930233m^{-1} \cdot 0.5 \cdot 1.225kg/m^3 \cdot (60m/s)^2 \cdot 0.6m \cdot 0.02454m^2}$$

19) Hinge Moment for given Gearing Ratio 

$$fx \quad H_e = \frac{F}{G}$$

Open Calculator 

$$ex \quad 24.99998N \cdot m = \frac{23.25581N}{0.930233m^{-1}}$$

20) Hinge Moment for given Stick Force 

$$fx \quad H_e = F \cdot l_s \cdot \frac{\delta_s}{\delta_e}$$

Open Calculator 

$$ex \quad 25N \cdot m = 23.25581N \cdot 0.215m \cdot \frac{0.5rad}{0.1rad}$$



21) Stick Deflection Angle for given Gearing Ratio 

$$fx \quad \delta_s = \frac{\delta_e}{l_s \cdot G}$$

Open Calculator 

$$ex \quad 0.5rad = \frac{0.1rad}{0.215m \cdot 0.930233m^{-1}}$$

22) Stick Deflection Angle for given Stick Force 

$$fx \quad \delta_s = H_e \cdot \frac{\delta_e}{F \cdot l_s}$$

Open Calculator 

$$ex \quad 0.5rad = 25N \cdot m \cdot \frac{0.1rad}{23.25581N \cdot 0.215m}$$

23) Stick Length for given Stick Force 

$$fx \quad l_s = H_e \cdot \frac{\delta_e}{F \cdot \delta_s}$$

Open Calculator 

$$ex \quad 0.215m = 25N \cdot m \cdot \frac{0.1rad}{23.25581N \cdot 0.5rad}$$



## Variables Used

- $c_e$  Elevator Chord (Meter)
- $Ch_e$  Hinge Moment Coefficient
- $S_e$  Elevator Area (Square Meter)
- $V$  Flight Velocity (Meter per Second)
- $\delta_e$  Elevator Deflection Angle (Radian)
- $\delta_s$  Stick Deflection Angle (Radian)
- $\rho$  Density (Kilogram per Cubic Meter)
- $G$  Gearing Ratio (1 per Meter)
- $H_e$  Hinge Moment (Newton Meter)
- $l_s$  Stick Length (Meter)
- $F$  Stick Force (Newton)



## Constants, Functions, Measurements used

- **Function:** **sqrt**,  $\text{sqrt}(\text{Number})$   
*A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.*
- **Measurement:** **Length** in Meter (m)  
*Length Unit Conversion* 
- **Measurement:** **Area** in Square Meter ( $\text{m}^2$ )  
*Area Unit Conversion* 
- **Measurement:** **Speed** in Meter per Second (m/s)  
*Speed Unit Conversion* 
- **Measurement:** **Force** in Newton (N)  
*Force Unit Conversion* 
- **Measurement:** **Angle** in Radian (rad)  
*Angle Unit Conversion* 
- **Measurement:** **Density** in Kilogram per Cubic Meter ( $\text{kg}/\text{m}^3$ )  
*Density Unit Conversion* 
- **Measurement:** **Moment of Force** in Newton Meter ( $\text{N}\cdot\text{m}$ )  
*Moment of Force Unit Conversion* 
- **Measurement:** **Reciprocal Length** in 1 per Meter ( $\text{m}^{-1}$ )  
*Reciprocal Length Unit Conversion* 



## Check other formula lists

- [Stick Forces and Hinge Moments Formulas](#) 

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