



Elliptical Lift Distribution Formulas

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List of 20 Elliptical Lift Distribution Formulas

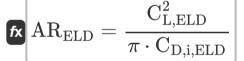
Elliptical Lift Distribution

1) Aspect Ratio given Induced Angle of Attack

$$oxed{AR_{
m ELD} = rac{C_{
m L,ELD}}{\pi \cdot lpha_{
m i}}}$$

 $2.470395 = \frac{1.49}{\pi \cdot 11^\circ}$

2) Aspect Ratio given Induced Drag Coefficient



3) Circulation at given Distance along Wingspan



 $ext{ex} 13.99862 ext{m}^2/ ext{s} = 14 ext{m}^2/ ext{s} \cdot \sqrt{1 - \left(2 \cdot rac{16.4 ext{mm}}{2340 ext{mm}}
ight)^2}$







4) Circulation at Origin given Downwash

fx $\Gamma_0 = -2 \cdot \mathbf{w} \cdot \mathbf{b}$

fx $\Gamma_{
m o}=2\cdot{
m b}\cdot{
m a_i}\cdot{
m V}_{\infty}$

Open Calculator 2

ex $14.04 {
m m}^2/{
m s} = -2 \cdot -3 {
m m/s} \cdot 2340 {
m mm}$

5) Circulation at Origin given Induced Angle of Attack

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 $\mathbf{ex} \ 13.92668 \mathrm{m}^2/\mathrm{s} = 2 \cdot 2340 \mathrm{mm} \cdot 11 \ \cdot 15.5 \mathrm{m/s}$

6) Circulation at Origin given Lift of Wing

 $\Gamma_{
m o} = 4 \cdot rac{{
m F}_{
m L}}{
ho_{
m co} \cdot {
m V}_{
m co} \cdot {
m b} \cdot \pi}$

Open Calculator

 $ag{14.0074 ext{m}^2/ ext{s} = 4 \cdot rac{488.8 ext{N}}{1.225 ext{kg/m}^3 \cdot 15.5 ext{m/s} \cdot 2340 ext{mm} \cdot \pi}}$

7) Circulation at Origin in Elliptical Lift Distribution

 $\left| \Gamma_{
m o} = 2 \cdot {
m V}_{\infty} \cdot {
m S}_0 \cdot rac{{
m C}_{
m l}}{\pi \cdot {
m h}}
ight|$

Open Calculator G

ex $13.97911 \mathrm{m}^2/\mathrm{s} = 2 \cdot 15.5 \mathrm{m/s} \cdot 2.21 \mathrm{m}^2 \cdot rac{1.5}{\pi \cdot 2340 \mathrm{mm}}$



8) Coefficient of Lift given Circulation at Origin

 $oldsymbol{\Gamma}_{
m L,ELD} = \pi \cdot {
m b} \cdot rac{\Gamma_{
m o}}{2 \cdot {
m V}_{\infty} \cdot {
m S}_0}$

Open Calculator

 $ag{1.502242} = \pi \cdot 2340 ext{mm} \cdot rac{14 ext{m}^2/ ext{s}}{2 \cdot 15.5 ext{m/s} \cdot 2.21 ext{m}^2}$

9) Coefficient of Lift given Induced Angle of Attack

fx $ext{C}_{ ext{L,ELD}} = \pi \cdot lpha_{ ext{i}} \cdot ext{AR}_{ ext{ELD}}$

Open Calculator

ex $1.495793=\pi\cdot11^{\circ}\cdot2.48$

10) Coefficient of Lift given Induced Drag Coefficient

 $ext{C}_{ ext{L,ELD}} = \sqrt{\pi \cdot ext{AR}_{ ext{ELD}} \cdot ext{C}_{ ext{D,i,ELD}}}$ ex $1.497949 = \sqrt{\pi \cdot 2.48 \cdot 0.288}$

Open Calculator 🗗

11) Downwash in Elliptical Lift Distribution

 $\mathbf{w} = -rac{\Gamma_{
m o}}{2 \cdot
m h}$

Open Calculator

 $ext{ex} ext{ -2.991453m/s} = -rac{14 ext{m}^2/ ext{s}}{2\cdot 2340 ext{mm}}$



12) Freestream Velocity given Circulation at Origin 🗗

$$V_{\infty} = \pi \cdot {
m b} \cdot rac{\Gamma_{
m o}}{2 \cdot {
m S}_0 \cdot {
m C}_{
m L,ELD}}$$

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Open Calculator

Open Calculator

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 $ag{15.62735 ext{m/s}} = \pi \cdot 2340 ext{mm} \cdot rac{14 ext{m}^2/ ext{s}}{2 \cdot 2.21 ext{m}^2 \cdot 1.49}$

13) Freestream Velocity given Induced Angle of Attack

fx $V_{\infty} = rac{\Gamma_{
m o}}{2 \cdot {
m b} \cdot {
m a.}}$

 $15.5816 \text{m/s} = \frac{14 \text{m}^2/\text{s}}{2 \cdot 2340 \text{mm} \cdot 11^{\circ}}$

14) Induced Angle of Attack given Aspect Ratio

 $lpha_{
m i} = rac{{
m C_l}}{\pi \cdot {
m AR_{ELD}}}$

 $ex 11.03094° = \frac{1.5}{\pi \cdot 2.48}$

15) Induced Angle of Attack given Circulation at Origin

 $oldsymbol{lpha_{
m i}} = rac{\Gamma_{
m o}}{2 \cdot {
m b} \cdot {
m V}_{\infty}}$

 $extbf{ex} 11.05791\degree = rac{14 ext{m}^2/ ext{s}}{2 \cdot 2340 ext{mm} \cdot 15.5 ext{m/s}}$

16) Induced Angle of Attack given Coefficient of Lift

 $oldsymbol{lpha_{
m i}} = {
m S}_0 \cdot rac{{
m C}_{
m l}}{\pi \cdot {
m b}^2}$

Open Calculator

ex $11.04141^\circ = 2.21 \mathrm{m}^2 \cdot rac{1.5}{\pi \cdot (2340 \mathrm{mm})^2}$

17) Induced Angle of Attack given Downwash

 $\left| lpha_{
m i} = - igg(rac{
m w}{
m V_{\infty}} igg)
ight|$

Open Calculator

 $oxed{egin{aligned} extbf{ex} 11.08951^\circ = -igg(rac{-3 ext{m/s}}{15.5 ext{m/s}}igg) \end{aligned}}$

18) Induced Drag Coefficient given Aspect Ratio

 $\mathbf{K} \left(\mathrm{C_{D,i,ELD}} = rac{\mathrm{C_{L,ELD}^2}}{\pi \cdot \mathrm{AR_{ELD}}}
ight)$

Open Calculator

 $\boxed{0.284952 = \frac{\left(1.49\right)^2}{\pi \cdot 2.48}}$



19) Lift at given Distance along Wingspan 🗗

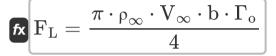
 $\mathbf{E} igg| L =
ho_\infty \cdot V_\infty \cdot \Gamma_o \cdot \sqrt{1 - \left(2 \cdot rac{a}{h}
ight)^2}$

Open Calculator

ex

$$265.7989 ext{N} = 1.225 ext{kg/m}^3 \cdot 15.5 ext{m/s} \cdot 14 ext{m}^2/ ext{s} \cdot \sqrt{1 - \left(2 \cdot rac{16.4 ext{mm}}{2340 ext{mm}}
ight)^2}$$

20) Lift of Wing given Circulation at Origin 🖸



Open Calculator

$$= \frac{\pi \cdot 1.225 \text{kg/m}^3 \cdot 15.5 \text{m/s} \cdot 2340 \text{mm} \cdot 14 \text{m}^2/\text{s}}{4}$$



Variables Used

- a Distance from Center to Point (Millimeter)
- AR_{ELD} Wing Aspect Ratio ELD
- **b** Wingspan (Millimeter)
- C_{D.i.ELD} Induced Drag Coefficient ELD
- C_I Lift Coefficient Origin
- C_{L.ELD} Lift Coefficient ELD
- **F**_I Lift Force (Newton)
- L Lift at Distance (Newton)
- **S**₀ Reference Area Origin (Square Meter)
- V_∞ Freestream Velocity (Meter per Second)
- **W** Downwash (Meter per Second)
- α_i Induced Angle of Attack (Degree)
- **Circulation** (Square Meter per Second)
- Γ_O Circulation at Origin (Square Meter per Second)
- ρ_∞ Freestream Density (Kilogram per Cubic Meter)





Constants, Functions, Measurements used

- Constant: pi, 3.14159265358979323846264338327950288
 Archimedes' constant
- Function: sqrt, sqrt(Number)
 Square root function
- Measurement: Length in Millimeter (mm)
 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: Angle in Degree (°)
 Angle Unit Conversion
- Measurement: Density in Kilogram per Cubic Meter (kg/m³)
 Density Unit Conversion
- Measurement: Momentum Diffusivity in Square Meter per Second (m²/s)
 Momentum Diffusivity Unit Conversion





Check other formula lists

• Elliptical Lift Distribution Formulas

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