calculatoratoz.com

unitsconverters.com

Steering System Formulas

Calculators! | Examples! | Conversions!

Bookmark **calculatoratoz.com**, **unitsconverters.com**

Widest Coverage of Calculators and Growing - **30,000+ Calculators!**
Calculate With a Different Unit for Each Variable - **In built Unit Conversion!**
Widest Collection of Measurements and Units - **250+ Measurements!**

Feel free to SHARE this document with your friends!

Please leave your feedback here...

List of 19 Steering System Formulas

Steering System

Angles Related to Steering System

1) Ackermann Steering Angle at High Cornering Speed

Open Calculator

fx $\delta_H = 57.3 \cdot \left(\frac{L}{R}\right) + (\alpha_{fw} - \alpha_{rw})$

ex $29\text{rad} = 57.3 \cdot \left(\frac{2700\text{mm}}{10000\text{mm}}\right) + (23.8\text{rad} - 10.271\text{rad})$

2) Ackermann Steering Angle at Low Speed Cornering

Open Calculator

fx $\delta_S = \frac{L}{R}$

ex $0.27\text{rad} = \frac{2700\text{mm}}{10000\text{mm}}$

3) Caster Angle

Open Calculator

fx $\Psi_c = \sin(C_1) - \sin(C_2) - (\cos(C_2) \cdot \cos(T_2) - \cos(C_1) \cdot \cos(T_1)) \cdot \frac{\tan(S)}{\cos(C_2) \cdot \sin(T_2) - \cos(}$

ex $0.067547\text{rad} = \sin(0.122\text{rad}) - \sin(0.09\text{rad}) - (\cos(0.09\text{rad}) \cdot \cos(0.165\text{rad}) - \cos(0.122\text{rad}) \cdot \cos(0.19\text{rad}))$

4) Slip Angle at High Cornering Speed

Open Calculator

fx $\alpha_s = \frac{F_y}{C_\alpha}$

ex $22\text{rad} = \frac{110\text{N}}{5}$

5) Steer Angle given Understeer Gradient

Open Calculator

$$\delta = \left(57.3 \cdot \left(\frac{L}{R}\right)\right) + \left(K \cdot A_a\right)$$

$$15.8198\text{rad} = \left(57.3 \cdot \left(\frac{2700\text{mm}}{10000\text{mm}}\right)\right) + \left(0.218\text{rad} \cdot 1.6\text{m/s}^2\right)$$

6) Vehicle Body Slip Angle at High Cornering Speed

Open Calculator

$$\beta = \frac{v}{v_t}$$

$$2\text{rad} = \frac{86\text{m/s}}{43\text{m/s}}$$

Steering Parameters

7) Angle of Inside Lock given Turning Radius of Inner Front Wheel

Open Calculator

$$\theta_{in} = a\sin\left(\frac{L}{R_{IF} + \frac{a_{tw} - c}{2}}\right)$$

$$0.756303\text{rad} = a\sin\left(\frac{2700\text{mm}}{3000\text{mm} + \frac{1999\text{mm} - 130\text{mm}}{2}}\right)$$

8) Angle of Inside Lock given Turning Radius of Inner Rear Wheel

Open Calculator

$$\theta_{in} = a\tan\left(\frac{L}{R_{IR} + \frac{a_{tw} - c}{2}}\right)$$

$$0.750646\text{rad} = a\tan\left(\frac{2700\text{mm}}{1960\text{mm} + \frac{1999\text{mm} - 130\text{mm}}{2}}\right)$$

9) Angle of Inside Wheel Lock Satisfying Correct Steering Condition

Open Calculator

$$\theta_{in} = a\cot\left(\cot(\theta_{out}) - \frac{c}{L}\right)$$

$$0.75\text{rad} = a\cot\left(\cot(0.728157\text{rad}) - \frac{130\text{mm}}{2700\text{mm}}\right)$$

10) Angle of Outside Lock given Turning Radius of Outer Front Wheel

Open Calculator

fx $$\theta_{out} = a\sin\left(\frac{L}{R_{OF} - \frac{a_{tw}-c}{2}}\right)$$

ex $$0.728515\text{rad} = a\sin\left(\frac{2700\text{mm}}{4990\text{mm} - \frac{1999\text{mm}-130\text{mm}}{2}}\right)$$

11) Angle of Outside Lock given Turning Radius of Outer Rear Wheel

Open Calculator

fx $$\theta_{out} = a\tan\left(\frac{L}{R_{OR} - \frac{a_{tw}-c}{2}}\right)$$

ex $$0.728608\text{rad} = a\tan\left(\frac{2700\text{mm}}{3960\text{mm} - \frac{1999\text{mm}-130\text{mm}}{2}}\right)$$

12) Angle of Outside Wheel Lock Satisfying Correct Steering Condition

Open Calculator

fx $$\theta_{out} = a\cot\left(\cot(\theta_{in}) + \frac{c}{L}\right)$$

ex $$0.728157\text{rad} = a\cot\left(\cot(0.75\text{rad}) + \frac{130\text{mm}}{2700\text{mm}}\right)$$

13) Mechanical Trail

Open Calculator

fx $$T_m = \frac{R_f \cdot \sin(\alpha_r) - d}{\cos(\alpha_r)}$$

ex $$84.67242\text{mm} = \frac{600\text{mm} \cdot \sin(0.16\text{rad}) - 12\text{mm}}{\cos(0.16\text{rad})}$$

14) Motion Ratio or Installation Ratio in Suspension

Open Calculator

fx $$M.R. = \frac{ST}{WT}$$

ex $$0.65 = \frac{65\text{mm}}{100\text{mm}}$$

15) Pinion Pitch Circle Radius

Open Calculator

$$R_p = \frac{t \cdot p}{2 \cdot \pi}$$

$$10.50423\text{mm} = \frac{6 \cdot 11\text{mm}}{2 \cdot \pi}$$

16) Steering Ratio

Open Calculator

$$S_r = \frac{R_{sw}}{R_p}$$

$$64 = \frac{672\text{mm}}{10.50\text{mm}}$$

17) Torque Acting on Steering Arm

Open Calculator

$$\tau = F_f \cdot R_s$$

$$45\text{N*m} = 150\text{N} \cdot 300\text{mm}$$

18) Understeer Gradient

Open Calculator

$$K = \left(\frac{F_{zf}}{g \cdot C_{af}}\right) - \left(\frac{F_{zr}}{g \cdot C_{ar}}\right)$$

$$0.218659\text{rad} = \left(\frac{9000\text{N}}{9.8\text{m/s}^2 \cdot 40\text{N}}\right) - \left(\frac{7800\text{N}}{9.8\text{m/s}^2 \cdot 35\text{N}}\right)$$

19) Understeer Increment due to Steering System Compliance

Open Calculator

$$K_{strg} = \frac{W_f \cdot (R \cdot \Psi_c + t_p)}{K_{ss}}$$

$$0.282188\text{rad} = \frac{1000\text{N} \cdot (10000\text{mm} \cdot 0.067547\text{rad} + 30\text{mm})}{2500\text{N*m}}$$

Variables Used

- a_{tw} Track Width of Vehicle *(Millimeter)*
- A_{α} Horizontal Lateral Acceleration *(Meter per Square Second)*
- **c** Distance between Front Wheel Pivot Center *(Millimeter)*
- C_1 Camber 1 *(Radian)*
- C_2 Camber 2 *(Radian)*
- C_{af} Cornering Stiffness of Front Wheels *(Newton)*
- C_{α} Cornering Stiffness
- $C_{\alpha r}$ Cornering Stiffness of Rear Wheels *(Newton)*
- **d** Triple Clamp Offset *(Millimeter)*
- F_f Frictional Force *(Newton)*
- F_y Cornering Force *(Newton)*
- F_{zf} Load on Front Axle at High Speed Cornering *(Newton)*
- F_{zr} Load on Rear Axle at High Speed Cornering *(Newton)*
- **g** Acceleration due to Gravity *(Meter per Square Second)*
- **K** Understeer Gradient *(Radian)*
- K_{ss} Effective Stiffness of Steering System *(Newton Meter)*
- K_{strg} Under Steer Increment due to Steering Compliance *(Radian)*
- **L** Wheelbase of Vehicle *(Millimeter)*
- **M.R.** Motion Ratio in Suspension
- **p** Linear or Circular Pitch *(Millimeter)*
- **R** Radius of Turn *(Millimeter)*
- R_f Front Tire Radius *(Millimeter)*
- R_{IF} Turning Radius of Inner Front Wheel *(Millimeter)*
- R_{IR} Turning Radius of Rear Inner Wheel *(Millimeter)*
- R_{OF} Turning Radius of Outer Front Wheel *(Millimeter)*
- R_{OR} Turning Radius of Outer Rear Wheel *(Millimeter)*
- R_p Pinion Pitch Circle Radius *(Millimeter)*
- R_s Scrub Radius *(Millimeter)*
- R_{sw} Steering Wheel Radius *(Millimeter)*
- **S** Steering Axis Inclination *(Radian)*
- S_r Steering Ratio
- **ST** Spring or Shock Travel *(Millimeter)*
- **t** Number of Pinion Teeth

- T_1 Toe Angle 1 *(Radian)*
- T_2 Toe Angle 2 *(Radian)*
- T_m Trail *(Millimeter)*
- t_p Pneumatic Trail of Tire *(Millimeter)*
- v Lateral Velocity Component *(Meter per Second)*
- v_t Total Velocity *(Meter per Second)*
- W_f Weight under Front Axle *(Newton)*
- WT Wheel Travel *(Millimeter)*
- α_{fw} Slip Angle of Front Wheel *(Radian)*
- α_r Rake Angle *(Radian)*
- α_{rw} Slip Angle of Rear Wheel *(Radian)*
- α_s Slip Angle at High Cornering Speed *(Radian)*
- β Vehicle Body Slip Angle *(Radian)*
- δ Steer Angle *(Radian)*
- δ_H Ackermann Steering Angle at High Cornering Speed *(Radian)*
- δ_S Ackermann Steering Angle in Slow Speed Cornering *(Radian)*
- θ_{in} Angle of Inside Wheel Lock *(Radian)*
- θ_{out} Angle of Outside Wheel Lock *(Radian)*
- τ Torque *(Newton Meter)*
- Ψ_c Caster Angle *(Radian)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Function: **acot**, acot(Number)
  The ACOT function calculates the arccotangent of a given number which is an angle given in radians from 0 (zero) to pi.
- Function: **asin**, asin(Number)
  The inverse sine function, is a trigonometric function that takes a ratio of two sides of a right triangle and outputs the angle opposite the side with the given ratio.
- Function: **atan**, atan(Number)
  Inverse tan is used to calculate the angle by applying the tangent ratio of the angle, which is the opposite side divided by the adjacent side of the right triangle.
- Function: **cos**, cos(Angle)
  Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.
- Function: **cot**, cot(Angle)
  Cotangent is a trigonometric function that is defined as the ratio of the adjacent side to the opposite side in a right triangle.
- Function: **sin**, sin(Angle)
  Sine is a trigonometric function that describes the ratio of the length of the opposite side of a right triangle to the length of the hypotenuse.
- Function: **tan**, tan(Angle)
  The tangent of an angle is a trigonometric ratio of the length of the side opposite an angle to the length of the side adjacent to an angle in a right triangle.
- Measurement: **Length** in Millimeter (mm)
  Length Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Acceleration** in Meter per Square Second (m/s²)
  Acceleration Unit Conversion
- Measurement: **Force** in Newton (N)
  Force Unit Conversion
- Measurement: **Angle** in Radian (rad)
  Angle Unit Conversion
- Measurement: **Torque** in Newton Meter (N*m)
  Torque Unit Conversion

Check other formula lists

- Forces on Steering System and Axles Formulas
- Movement Ratio Formulas
- Steering System Formulas
- Turning Dynamics Formulas

Feel free to SHARE this document with your friends!

PDF Available in

English Spanish French German Russian Italian Portuguese Polish Dutch

8/14/2024 | 5:11:58 AM UTC

Please leave your feedback here...