Driveline Formulas... 1/13





Driveline Formulas

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List of 20 Driveline Formulas

Driveline 🗗

1) Aerodynamic Resistance 🛂

 $\mathbf{F}_{\mathrm{ar}} = 0.5 \cdot
ho \cdot \mathrm{A} \cdot \mathrm{V}_{c}^{2} \cdot \mathrm{C}_{\mathrm{D}}$

Open Calculator

Open Calculator

 $ext{ex} \ 250.0119 ext{N} = 0.5 \cdot 1.293 ext{kg/m}^3 \cdot 1.7 ext{m}^2 \cdot \left(22 ext{m/s}
ight)^2 \cdot 0.47$

2) Angular Acceleration of Driven Shaft 🗗

 $\alpha_{B} = -\omega_{B}^{2} \cdot \cos(\alpha) \cdot \sin(\alpha)^{2} \cdot \frac{\sin(2 \cdot \Phi)}{\left(1 - \cos(\Phi)^{2} \cdot \sin(\alpha)^{2}\right)^{2}}$

ex

fx

 $14.75256 {\rm rad/s^2} = -{{(62 {\rm rad/s})}^2} \cdot {{\cos(5°)}} \cdot {\sin(5°)}^2 \cdot \frac{{\sin(2 \cdot 15°)}}{{{{\left(1 - {\cos(15°)}^2 \cdot {\sin(5°)}^2}\right)}^2}}$

3) Axial Force of Multiplate Clutch using Uniform Wear Theory

fx $F_{
m a} = \pi \cdot {
m p} \cdot {
m D_i} \cdot ({
m D_o} - {
m D_i}) \cdot 0.5$

Open Calculator

 $\texttt{ex} \ 9424.778 \text{N} = \pi \cdot 400000 \text{N/m}^2 \cdot 0.150 \text{m} \cdot (0.250 \text{m} - 0.150 \text{m}) \cdot 0.5$



4) Drawbar Pull

 $ext{Dp} = rac{ ext{T}_{ ext{g}} \cdot ext{R}_{ ext{Gear}} \cdot 1000}{ ext{r}} - ext{F}_{ ext{r}}$

Open Calculator

= $2854 \mathrm{N} = rac{115 \mathrm{N^*mm \cdot 10 \cdot 1000}}{0.4 \mathrm{m}} - 21 \mathrm{N}$

5) Effective Gear Ratio

 $\mathrm{Gr}_{\mathrm{eff}} = rac{\mathrm{D}_{\mathrm{old}}}{\mathrm{D}_{\mathrm{new}}} \cdot \mathrm{i}_{\mathrm{g}}$

Open Calculator

 $= 2.743182 = \frac{0.710 \text{m}}{0.660 \text{m}} \cdot 2.55$

6) Engine Torque

 $ag{T} = rac{9.55 \cdot P_v}{N}$

Open Calculator

 $= 19100 N*mm = \frac{9.55 \cdot 12000W}{6000}$

7) Final Drive Ratio

fx $\overline{\mathrm{F} = \mathrm{Gr}_{\mathrm{rear}} \cdot \mathrm{Or}}$

Open Calculator

 $\boxed{2.6 = 4 \cdot 0.65}$



8) Gear Step

 $\phi = rac{i_{ ext{n-1}}}{i_{ ext{n-1}}}$

Open Calculator

 $= 1.34593 = \frac{4.63}{3.44}$

9) Percentage Gradeability of Vehicle

extstyle ext

Open Calculator

 $= \frac{10200 \cdot 115\text{N*mm} \cdot 10}{0.4\text{m} \cdot 4500\text{kg}} - 1.5$

10) Power Required to Propel Vehicle

 $P_v = rac{R_{Total} \cdot V_s}{\eta_t}$

Open Calculator 🗗

 $extbf{ex} 12046.99 ext{W} = rac{495 ext{N} \cdot 20.2 ext{m/s}}{0.83}$

11) Total Resistance on Vehicle

 $m R_{Total} = F_{ar} + F_r + F_g$

Open Calculator

12) Velocity Ratio of Hooke's Joint

$$V = rac{\cos(lpha)}{1-\left(\cos(heta)
ight)^2\cdot\left(\sin(lpha)
ight)^2}$$

Open Calculator

13) Weight on Front Axle

fx
$$W_{
m f}=W-W_{
m r}$$

Open Calculator

$$ex 5000 kg = 10000 kg - 5000 kg$$

14) Weight on Rear Axle



Open Calculator 🖸

$= \frac{5000 \text{kg}}{5000 \text{kg}} = \frac{10000 \text{kg} \cdot 2.2 \text{m}}{4.4 \text{m}}$

Driveline Angular Velocity 🖸

15) Angular Velocity of Driven Shaft 🗗

$$\mathbf{k} = \left(rac{\cos(lpha)}{1 - \left(\cos(heta)
ight)^2 \cdot \left(\sin(lpha)
ight)^2}
ight) \cdot \omega_{\mathrm{A}}$$

Open Calculator





16) Angular Velocity of Driving Shaft 🚰

 $\omega_{
m A} = rac{\omega_{
m B}}{rac{\cos(lpha)}{1-(\cos(heta))^2\cdot(\sin(lpha))^2}}$

Open Calculator

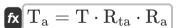
17) Angular Velocity of Driving Shaft given Angular Acceleration of Driven Shaft

 $\omega_{\mathrm{B}} = \sqrt{rac{lpha_{\mathrm{B}} \cdot \left(1 - \cos(\Phi)^2 \cdot \sin(lpha)^2
ight)^2}{\cos(lpha) \cdot \sin(lpha)^2 \cdot \sin(2 \cdot \Phi)}}$

Open Calculator

Driveline Torque

18) Torque available at Driving Axle 🗗

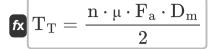


Open Calculator 🗗

$$= 343227 \text{N*mm} = 19100 \text{N*mm} \cdot 3 \cdot 5.99$$

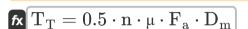


19) Torque Transmitted by n Friction Surfaces



Open Calculator

20) Torque Transmitted by n Friction Surfaces using Uniform Wear Theory



Open Calculator 🗗



Driveline Formulas... 8/13

Variables Used

- A Frontal Area of Vehicle (Square Meter)
- **b** Wheelbase of Vehicle (*Meter*)
- C_D Coefficient of Drag Exerted by Flow
- CGf CG Distance from Front Axle (Meter)
- D_i Inner Diameter of Friction Disc (Meter)
- **D**_m Mean Diameter of Friction Disc (Meter)
- Dnew New Tire Diameter (Meter)
- **D**_O Outer Diameter of Friction Disc (Meter)
- **D**old Old Tire Diameter (Meter)
- Dp Drawbar Pull (Newton)
- F Final Drive Ratio
- **F**_a Total Axial Load (Newton)
- Far Aerodynamic Resistance of Vehicle (Newton)
- F_α Gradient Resistance (Newton)
- **F**_r Rolling Resistance at Wheel (Newton)
- G Gradeability of Vehicle
- Gr_{eff} Effective Gear Ratio
- Grrear Rear Gear Ratio
- GVW Gross Vehicle Weight (Kilogram)
- ia Gear Ratio of Transmission
- in Gear Ratio Number
- in-1 Preceding Lower Gear Ratio Number
- n Number of Friction Discs
- N Engine Speed in rpm





Driveline Formulas... 9/13

- Or Overdrive Ratio
- p Pressure of Intensity (Newton per Square Meter)
- Pv Power required to Propel a Vehicle (Watt)
- r Rolling Radius of Loaded Driving Tire (Meter)
- Ra Axle Gear Reduction
- R_{Gear} Overall Gear Reduction
- Rta Gear Reduction through Auxiliary Transmission
- R_{Total} Total Resistance on Vehicle (Newton)
- Rr Percentage Rolling Resistance
- **T** Engine Torque (Newton Millimeter)
- T_a Torque available at Driving Axle (Newton Millimeter)
- T_q Torque Generated (Newton Millimeter)
- T_T Torque Transmitted (Newton Millimeter)
- V Velocity Ratio
- V_C Cruising Speed of Vehicle (Meter per Second)
- V_s Speed of Vehicle in Meter per Second (Meter per Second)
- W Total Weight being Distributed of Vehicle (Kilogram)
- W_f Weight on Front Axle (Kilogram)
- W_r Weight on Rear Axle (Kilogram)
- α Angle between Driving and Driven Shafts (Degree)
- α_R Angular Acceleration of Driven Shaft (Radian per Square Second)
- η_t Transmission Efficiency of Vehicle
- θ Angle Rotated by Driving Shaft (Degree)
- µ Coefficient of Friction Disc
- Density of Air (Kilogram per Cubic Meter)
- φ Gear Step
- Φ Angle Rotated by Driven Shaft (Degree)





Driveline Formulas... 10/13

• ω_A Angular Velocity of Driving Shaft (Radian per Second)

• ω_B Angular Velocity of Driven Shaft (Radian per Second)





Driveline Formulas... 11/13

Constants, Functions, Measurements used

- Constant: pi, 3.14159265358979323846264338327950288
 Archimedes' constant
- Function: cos, cos(Angle)

 Trigonometric cosine function
- Function: sin, sin(Angle)

 Trigonometric sine function
- Function: sqrt, sqrt(Number) Square root function
- Measurement: Length in Meter (m)
 Length Unit Conversion
- Measurement: Weight in Kilogram (kg)
 Weight Unit Conversion
- Measurement: Area in Square Meter (m²)

 Area Unit Conversion
- Measurement: Pressure in Newton per Square Meter (N/m²)

 Pressure Unit Conversion
- Measurement: Speed in Meter per Second (m/s)
 Speed Unit Conversion
- Measurement: Power in Watt (W)
 Power Unit Conversion
- Measurement: Force in Newton (N)
 Force Unit Conversion
- Measurement: Angle in Degree (°)
 Angle Unit Conversion
- Measurement: Angular Velocity in Radian per Second (rad/s)
 Angular Velocity Unit Conversion
- Measurement: Density in Kilogram per Cubic Meter (kg/m³)
 Density Unit Conversion





Driveline Formulas... 12/13

Measurement: Torque in Newton Millimeter (N*mm)
 Torque Unit Conversion

• Measurement: Angular Acceleration in Radian per Square Second (rad/s²)

Angular Acceleration Unit Conversion





Driveline Formulas... 13/13

Check other formula lists

Driveline Formulas

- Vehicle Collision Formulas
- Suspension Geometry Formulas

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