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DC Machine Characterstics Formulas

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List of 16 DC Machine Characterstics Formulas

DC Machine Characterstics

1) Angular Speed of DC Machine using Kf

Open Calculator

fx $$\omega_s = \frac{V_a}{K_f \cdot \Phi \cdot I_a}$$

ex $$321.0685\text{rad/s} = \frac{200\text{V}}{2.864 \cdot 0.29\text{Wb} \cdot 0.75\text{A}}$$

2) Armature Induced Voltage of DC Machine given Kf

Open Calculator

fx $$V_a = K_f \cdot I_a \cdot \Phi \cdot \omega_s$$

ex $$199.9573\text{V} = 2.864 \cdot 0.75\text{A} \cdot 0.29\text{Wb} \cdot 321\text{rad/s}$$

3) Back EMF of DC Generator

Open Calculator

fx $$E_b = V_o - (I_a \cdot R_a)$$

ex $$90\text{V} = 150\text{V} - (0.75\text{A} \cdot 80\Omega)$$

4) Back Pitch for DC Machine

Open Calculator

fx $$Y_b = \left(\frac{2 \cdot n_{slot}}{P}\right) + 1$$

ex $$22.33333 = \left(\frac{2 \cdot 96}{9}\right) + 1$$

5) Back Pitch for DC Machine given Coil Span

Open Calculator

fx $$Y_b = U \cdot K_c$$

ex $$22.32 = 2.79 \cdot 8$$

6) Coil Span of DC Motor

Open Calculator

fx $$K_c = \frac{n_c}{P}$$

ex $$8 = \frac{72}{9}$$

7) Design Constant of DC Machine

Open Calculator

fx $$K_f = \frac{Z \cdot P}{2 \cdot \pi \cdot n_{ll}}$$

ex $$2.864789 = \frac{12 \cdot 9}{2 \cdot \pi \cdot 6}$$

8) Electrical Efficiency of DC Machine

Open Calculator

$$\eta_e = \frac{\eta_m \cdot \omega_s \cdot \tau}{V_o \cdot I_a}$$

$$0.866843 = \frac{0.49 \cdot 321\text{rad/s} \cdot 0.62\text{N*m}}{150\text{V} \cdot 0.75\text{A}}$$

9) EMF Generated in DC Machine with Lap Winding

Open Calculator

$$E = \frac{N_r \cdot Z \cdot \Phi_p}{60}$$

$$14.4\text{V} = \frac{1200\text{rev/min} \cdot 12 \cdot 0.06\text{Wb}}{60}$$

10) Front Pitch for DC Machine

Open Calculator

$$Y_F = \left(\frac{2 \cdot n_{slot}}{P}\right) - 1$$

$$20.33333 = \left(\frac{2 \cdot 96}{9}\right) - 1$$

11) Input Power of DC Motor

Open Calculator

$$P_{in} = V_s \cdot I_a$$

$$180\text{W} = 240\text{V} \cdot 0.75\text{A}$$

12) Magnetic Flux of DC Machine given Torque

Open Calculator

fx $$\Phi = \frac{\tau}{K_f \cdot I_a}$$

ex $$0.288641\text{Wb} = \frac{0.62\text{N*m}}{2.864 \cdot 0.75\text{A}}$$

13) Mechanical Efficiency given Induced Voltage and Armature Current

Open Calculator

fx $$\eta_m = \frac{\eta_e \cdot V_o \cdot I_a}{\omega_s \cdot \tau}$$

ex $$0.486132 = \frac{0.86 \cdot 150\text{V} \cdot 0.75\text{A}}{321\text{rad/s} \cdot 0.62\text{N*m}}$$

14) Output Power of DC Machine

Open Calculator

fx $$P_o = \omega_s \cdot \tau$$

ex $$199.02\text{W} = 321\text{rad/s} \cdot 0.62\text{N*m}$$

15) Pole Pitch in DC Generator

Open Calculator

fx $$Y_P = \frac{n_{slot}}{P}$$

ex $$10.66667 = \frac{96}{9}$$

16) Torque generated in DC Machine

Open Calculator

fx $\tau = K_f \cdot \Phi \cdot I_a$

ex $0.62292\text{N*m} = 2.864 \cdot 0.29\text{Wb} \cdot 0.75\text{A}$

Variables Used

- E EMF *(Volt)*
- E_b Back EMF *(Volt)*
- I_a Armature Current *(Ampere)*
- K_c Coil Span Factor
- K_f Machine Constant
- n_c Number of Commutator Segments
- n_{ll} Number of Parallel Paths
- N_r Rotor Speed *(Revolution per Minute)*
- n_{slot} Number of Slots
- P Number of Poles
- P_{in} Input Power *(Watt)*
- P_o Output Power *(Watt)*
- R_a Armature Resistance *(Ohm)*
- U Coil Span
- V_a Armature Voltage *(Volt)*
- V_o Output Voltage *(Volt)*
- V_s Supply Voltage *(Volt)*
- Y_b Back Pitch
- Y_F Front Pitch
- Y_P Pole Pitch
- Z Number of Conductors

- η_e Electrical Efficiency
- η_m Mechanical Efficiency
- τ Torque *(Newton Meter)*
- Φ Magnetic Flux *(Weber)*
- Φ_p Flux per Pole *(Weber)*
- ω_s Angular Speed *(Radian per Second)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Measurement: **Electric Current** in Ampere (A)
  Electric Current Unit Conversion
- Measurement: **Power** in Watt (W)
  Power Unit Conversion
- Measurement: **Magnetic Flux** in Weber (Wb)
  Magnetic Flux Unit Conversion
- Measurement: **Electric Resistance** in Ohm (Ω)
  Electric Resistance Unit Conversion
- Measurement: **Electric Potential** in Volt (V)
  Electric Potential Unit Conversion
- Measurement: **Angular Velocity** in Radian per Second (rad/s), Revolution per Minute (rev/min)
  Angular Velocity Unit Conversion
- Measurement: **Torque** in Newton Meter (N*m)
  Torque Unit Conversion

Check other formula lists

- **DC Machine Characterstics Formulas**

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