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DC Drives Formulas

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List of 11 DC Drives Formulas

DC Drives ⤴

Single Phase Drives ⤴

1) Average Armature Voltage of Single Phase Full-Converter Drives ⤴

Open Calculator ⤴

$$fx \quad V_{a(full)} = \frac{2 \cdot V_m \cdot \cos(\alpha)}{\pi}$$

$$ex \quad 47.90209V = \frac{2 \cdot 220V \cdot \cos(70°)}{\pi}$$

2) Average Armature Voltage of Single Phase Half-Wave Converter Drive ⤴

Open Calculator ⤴

$$fx \quad V_{a(half)} = \frac{V_m}{2 \cdot \pi} \cdot (1 + \cos(\alpha))$$

$$ex \quad 46.98961V = \frac{220V}{2 \cdot \pi} \cdot (1 + \cos(70°))$$

3) Average Field Voltage of Single Phase Semi-Converter Drives ⤴

Open Calculator ⤴

$$fx \quad V_{f(semi)} = \left(\frac{V_m}{\pi}\right) \cdot (1 + \cos(\alpha))$$

$$ex \quad 93.97922V = \left(\frac{220V}{\pi}\right) \cdot (1 + \cos(70°))$$

4) Input Power of Single Phase Full Converter Drives 🔗

Open Calculator 🔗

$$fx \quad P_{in} = \left(\frac{2 \cdot \sqrt{2}}{\pi} \right) \cdot \cos(\alpha)$$

$$ex \quad 0.307926W = \left(\frac{2 \cdot \sqrt{2}}{\pi} \right) \cdot \cos(70°)$$

5) RMS Value of Freewheeling Diode Current in Half Wave Converter Drives 🔗

Open Calculator 🔗

$$fx \quad I_{fdr} = I_a \cdot \sqrt{\frac{\pi + \alpha}{2 \cdot \pi}}$$

$$ex \quad 25A = 30A \cdot \sqrt{\frac{\pi + 70°}{2 \cdot \pi}}$$

6) RMS Value of Thyristor Current in Half Wave Converter Drives 🔗

Open Calculator 🔗

$$fx \quad I_{sr} = I_a \cdot \left(\frac{\pi - \alpha}{2 \cdot \pi} \right)^{\frac{1}{2}}$$

$$ex \quad 16.58312A = 30A \cdot \left(\frac{\pi - 70°}{2 \cdot \pi} \right)^{\frac{1}{2}}$$

Three Phase Drives 🔗

7) Air Gap Power in Three Phase Induction Motor Drives 🔗

Open Calculator 🔗

fx $$P_g = 3 \cdot I_2^2 \cdot \left(\frac{r_2}{s} \right)$$

ex $$21.93485W = 3 \cdot (1.352A)^2 \cdot \left(\frac{0.4\Omega}{0.1} \right)$$

8) Armature Terminal Voltage in Half-Wave Converter Drives 🔗

Open Calculator 🔗

fx $$V_o = \left(\frac{3 \cdot V_{ml}}{2 \cdot \pi} \right) \cdot \cos(\alpha)$$

ex $$34.29354V = \left(\frac{3 \cdot 210V}{2 \cdot \pi} \right) \cdot \cos(70°)$$

9) Average Armature Voltage of Three Phase Full-Converter Drives 🔗

Open Calculator 🔗

fx $$V_{a(full\_3p)} = \frac{3 \cdot \sqrt{3} \cdot V_m \cdot \cos(\alpha)}{\pi}$$

ex $$124.4533V = \frac{3 \cdot \sqrt{3} \cdot 220V \cdot \cos(70°)}{\pi}$$

10) Average Field Voltage of Three Phase Semi-Converter Drive ⤤

Open Calculator ⤤

$$fx \quad V_{f(semi\_3p)} = \frac{3 \cdot V_m \cdot (1 + \cos(\alpha))}{2 \cdot \pi}$$

$$ex \quad 140.9688V = \frac{3 \cdot 220V \cdot (1 + \cos(70°))}{2 \cdot \pi}$$

11) Maximum Torque in Induction Motor Drives ⤤

Open Calculator ⤤

$$fx \quad \zeta_{max} = \left(\frac{3}{2 \cdot \omega_s}\right) \cdot \frac{V_1^2}{r_1 + \sqrt{r_1^2 + (x_1 + x_2)^2}}$$

$$ex \quad 127.8202N*m = \left(\frac{3}{2 \cdot 157m/s}\right) \cdot \frac{(230V)^2}{0.6\Omega + \sqrt{(0.6\Omega)^2 + (1.6\Omega + 1.7\Omega)^2}}$$

Variables Used

- I_2 Rotor Current *(Ampere)*
- I_a Armature Current *(Ampere)*
- I_{fdr} RMS Freewheeling Diode Current *(Ampere)*
- I_{sr} RMS of Source Current *(Ampere)*
- P_g Air Gap Power *(Watt)*
- P_{in} Input Power *(Watt)*
- r_1 Stator Resistance *(Ohm)*
- r_2 Rotor Resistance *(Ohm)*
- s Slip
- V_1 Terminal Voltage *(Volt)*
- $V_{a(full)}$ Full Drive Armature Voltage *(Volt)*
- $V_{a(full\_3p)}$ Full Drive Armature Voltage in Three Phase *(Volt)*
- $V_{a(half)}$ Half Drive Armature Voltage *(Volt)*
- $V_{f(semi)}$ Semi Drive Field Voltage *(Volt)*
- $V_{f(semi\_3p)}$ Semi Drive Field Voltage in Three Phase *(Volt)*
- V_m Peak Input Voltage *(Volt)*
- V_{ml} Maximum Line Voltage *(Volt)*
- V_o Average Output Voltage *(Volt)*
- x_1 Stator Leakage Reactance *(Ohm)*
- x_2 Rotor Leakage Reactance *(Ohm)*
- α Delay Angle of Thyristor *(Degree)*

- ζ_{max} Maximum Torque *(Newton Meter)*

- ω_s Synchronous Speed *(Meter per Second)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant

- Function: **cos**, cos(Angle)
  Trigonometric cosine function

- Function: **sqrt**, sqrt(Number)
  Square root function

- Measurement: **Electric Current** in Ampere (A)
  Electric Current Unit Conversion 🔗

- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion 🔗

- Measurement: **Power** in Watt (W)
  Power Unit Conversion 🔗

- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion 🔗

- Measurement: **Electric Resistance** in Ohm (Ω)
  Electric Resistance Unit Conversion 🔗

- Measurement: **Electric Potential** in Volt (V)
  Electric Potential Unit Conversion 🔗

- Measurement: **Torque** in Newton Meter (N*m)
  Torque Unit Conversion 🔗

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