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Line Performance Characteristics Formulas

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List of 15 Line Performance Characteristics Formulas

Line Performance Characteristics

1) Base Current

Open Calculator

fx $$I_{pu(b)} = \frac{P_b}{V_{base}}$$

ex $$40A = \frac{10000VA}{250V}$$

2) Base Current for Three-Phase System

Open Calculator

fx $$I_b = \frac{P_b}{\sqrt{3} \cdot V_{base}}$$

ex $$23.09401A = \frac{10000VA}{\sqrt{3} \cdot 250V}$$

3) Base Impedance given Base Current

Open Calculator

fx $$Z_{base} = \frac{V_{base}}{I_{pu(b)}}$$

ex $$6.25\Omega = \frac{250V}{40A}$$

4) Base Power

Open Calculator

fx $$P_b = V_{base} \cdot I_b$$

ex $$5772.5VA = 250V \cdot 23.09A$$

5) Base Voltage

Open Calculator

fx $$V_{base} = \frac{P_b}{I_{pu(b)}}$$

ex $$250V = \frac{10000VA}{40A}$$

6) B-Parameter using Receiving End Reactive Power Component

Open Calculator

$$B = \frac{((V_r \cdot V_s) \cdot \cos(\beta - \angle\alpha)) - \left(A \cdot \left(V_r^2\right) \cdot \cos(\beta - \angle\alpha)\right)}{Q}$$

$$9.698525\Omega = \frac{((380\text{V} \cdot 400\text{V}) \cdot \cos(20^\circ - 125^\circ)) - \left(1.09 \cdot \left((380\text{V})^2\right) \cdot \cos(20^\circ - 125^\circ)\right)}{144\text{VAR}}$$

7) B-Parameter using Receiving End Real Power Component

Open Calculator

$$B = \frac{((V_r \cdot V_s) \cdot \sin(\beta - \angle\alpha)) - \left(A \cdot V_r^2 \cdot \sin(\beta - \angle\alpha)\right)}{P}$$

$$11.50582\Omega = \frac{((380\text{V} \cdot 400\text{V}) \cdot \sin(20^\circ - 125^\circ)) - \left(1.09 \cdot (380\text{V})^2 \cdot \sin(20^\circ - 125^\circ)\right)}{453\text{W}}$$

8) Complex Power given Current

Open Calculator

$$S = I^2 \cdot Z$$

$$329.9415\text{VA} = (23.45\text{A})^2 \cdot 0.6\Omega$$

9) Dielectric Loss due to Heating in Cables

Open Calculator

$$D_f = \omega \cdot C \cdot V^2 \cdot \tan(\angle\delta)$$

$$232.7876\text{W} = 10\text{rad/s} \cdot 2.8\text{mF} \cdot (120\text{V})^2 \cdot \tan(30^\circ)$$

10) Penetration Depth of Eddy Currents

Open Calculator

$$\delta_p = \frac{1}{\sqrt{\pi \cdot f \cdot \mu \cdot \sigma_c}}$$

$$0.004093\text{cm} = \frac{1}{\sqrt{\pi \cdot 5\text{MHz} \cdot 0.95\text{H/m} \cdot 0.4\text{S/cm}}}$$

11) Phase Current for Balanced Three-Phase Delta Connection

Open Calculator

fx $$I_{ph} = \frac{I_{line}}{\sqrt{3}}$$

ex $$2.078461\text{A} = \frac{3.6\text{A}}{\sqrt{3}}$$

12) Phase Voltage for Balanced Three-Phase Star Connection

Open Calculator

fx $$V_{ph} = \frac{V_{line}}{\sqrt{3}}$$

ex $$10.79645\text{V} = \frac{18.70\text{V}}{\sqrt{3}}$$

13) Receiving End Real Power Component

Open Calculator

fx $$P = \left(\left(V_r \cdot \frac{V_s}{B}\right) \cdot \sin(\beta - \angle\alpha)\right) - \left(\frac{A \cdot \left(V_r^2\right) \cdot \sin(\beta - \angle\alpha)}{B}\right)$$

ex $$453.2292\text{W} = \left(\left(380\text{V} \cdot \frac{400\text{V}}{11.5\Omega}\right) \cdot \sin(20^\circ - 125^\circ)\right) - \left(\frac{1.09 \cdot \left((380\text{V})^2\right) \cdot \sin(20^\circ - 125^\circ)}{11.5\Omega}\right)$$

14) Sag of Transmission Line

Open Calculator

fx $$s = \frac{W_c \cdot L^2}{8 \cdot T}$$

ex $$3.292774\text{m} = \frac{0.604\text{kg} \cdot (260\text{m})^2}{8 \cdot 1550\text{kg}}$$

15) Skin Depth in Conductor

Open Calculator

fx $$\delta = \sqrt{\frac{R_s}{f \cdot \mu_r \cdot 4 \cdot \pi \cdot 10^{-7}}}$$

ex $$0.000448\text{m} = \sqrt{\frac{113.59\mu\Omega*\text{cm}}{5\text{MHz} \cdot 0.9 \cdot 4 \cdot \pi \cdot 10^{-7}}}$$

Variables Used

- ∠α Alpha A-Parameter *(Degree)*
- ∠δ Loss Angle *(Degree)*
- **A** A Parameter
- **B** B Parameter *(Ohm)*
- **C** Capacitance *(Millifarad)*
- D_f Dielectric Loss *(Watt)*
- **f** Frequency *(Megahertz)*
- **I** Electric Current *(Ampere)*
- I_b Base Current *(Ampere)*
- I_{line} Line Current *(Ampere)*
- I_{ph} Phase Current *(Ampere)*
- $I_{pu(b)}$ Base Current (PU) *(Ampere)*
- **L** Span Length *(Meter)*
- **P** Real Power *(Watt)*
- P_b Base Power *(Volt Ampere)*
- **Q** Reactive Power *(Volt Ampere Reactive)*
- R_s Specific Resistance *(Microhm Centimeter)*
- **s** Sag of Transmission Line *(Meter)*
- **S** Complex Power *(Volt Ampere)*
- **T** Working Tension *(Kilogram)*
- **V** Voltage *(Volt)*
- V_{base} Base Voltage *(Volt)*
- V_{line} Line Voltage *(Volt)*
- V_{ph} Phase Voltage *(Volt)*
- V_r Receiving End Voltage *(Volt)*
- V_s Sending End Voltage *(Volt)*
- W_c Weight of Conductor *(Kilogram)*
- **Z** Impedance *(Ohm)*
- Z_{base} Base Impedance *(Ohm)*
- β Beta B-Parameter *(Degree)*
- δ Skin Depth *(Meter)*

- δ_p Penetration Depth *(Centimeter)*
- μ Magnetic Permeability of Medium *(Henry per Meter)*
- μ_r Relative Permeability
- σ_c Electrical Conductivity *(Siemens per Centimeter)*
- ω Angular Frequency *(Radian per Second)*

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
- Function: **tan**, tan(Angle)
  Trigonometric tangent function
- Measurement: **Length** in Centimeter (cm), Meter (m)
  Length Unit Conversion
- Measurement: **Weight** in Kilogram (kg)
  Weight Unit Conversion
- Measurement: **Electric Current** in Ampere (A)
  Electric Current Unit Conversion
- Measurement: **Power** in Volt Ampere (VA), Volt Ampere Reactive (VAR), Watt (W)
  Power Unit Conversion
- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion
- Measurement: **Frequency** in Megahertz (MHz)
  Frequency Unit Conversion
- Measurement: **Capacitance** in Millifarad (mF)
  Capacitance Unit Conversion
- Measurement: **Electric Resistance** in Ohm (Ω)
  Electric Resistance Unit Conversion
- Measurement: **Electric Potential** in Volt (V)
  Electric Potential Unit Conversion
- Measurement: **Electric Resistivity** in Microhm Centimeter (μΩ*cm)
  Electric Resistivity Unit Conversion
- Measurement: **Electric Conductivity** in Siemens per Centimeter (S/cm)
  Electric Conductivity Unit Conversion
- Measurement: **Magnetic Permeability** in Henry per Meter (H/m)
  Magnetic Permeability Unit Conversion

- Measurement: **Angular Frequency** in Radian per Second (rad/s)
  Angular Frequency Unit Conversion

Check other formula lists

- **Line Performance Characteristics Formulas**
- **Short Line Formulas**
- **Long Transmission Line Formulas**
- **Transient Formulas**
- **Medium Line Formulas**

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