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Long Transmission Line Formulas

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List of 26 Long Transmission Line Formulas

Long Transmission Line ↗

Current & Voltage ↗

1) Receiving End Current using Sending End Current (LTL) ↗

$$fx \quad I_r = \frac{I_s - \left(V_r \cdot \frac{\sinh(\gamma \cdot L)}{Z_0} \right)}{\cosh(\gamma \cdot L)}$$

[Open Calculator ↗](#)

$$ex \quad 6.189958A = \frac{3865.49A - \left(8.88kV \cdot \frac{\sinh(1.24 \cdot 3m)}{48.989\Omega} \right)}{\cosh(1.24 \cdot 3m)}$$

2) Receiving End Current using Sending End Voltage (LTL) ↗

$$fx \quad I_r = \frac{V_s - (V_r \cdot \cosh(\gamma \cdot L))}{Z_0 \cdot \sinh(\gamma \cdot L)}$$

[Open Calculator ↗](#)

$$ex \quad 6.185663A = \frac{189.57kV - (8.88kV \cdot \cosh(1.24 \cdot 3m))}{48.989\Omega \cdot \sinh(1.24 \cdot 3m)}$$



3) Receiving End Voltage using Sending End Current (LTL) ↗

fx $V_r = (I_s - I_r \cdot \cosh(\gamma \cdot L)) \cdot \left(\frac{Z_0}{\sinh(\gamma \cdot L)} \right)$

[Open Calculator ↗](#)
ex

$$8.879998\text{kV} = (3865.49\text{A} - 6.19\text{A} \cdot \cosh(1.24 \cdot 3\text{m})) \cdot \left(\frac{48.989\Omega}{\sinh(1.24 \cdot 3\text{m})} \right)$$

4) Sending End Current (LTL) ↗

fx $I_s = I_r \cdot \cosh(\gamma \cdot L) + \left(\frac{V_r \cdot \sinh(\gamma \cdot L)}{Z_0} \right)$

[Open Calculator ↗](#)

ex $3865.491\text{A} = 6.19\text{A} \cdot \cosh(1.24 \cdot 3\text{m}) + \left(\frac{8.88\text{kV} \cdot \sinh(1.24 \cdot 3\text{m})}{48.989\Omega} \right)$

5) Sending End Voltage (LTL) ↗

fx $V_s = V_r \cdot \cosh(\gamma \cdot L) + Z_0 \cdot I_r \cdot \sinh(\gamma \cdot L)$

[Open Calculator ↗](#)
ex

$$189.5744\text{kV} = 8.88\text{kV} \cdot \cosh(1.24 \cdot 3\text{m}) + 48.989\Omega \cdot 6.19\text{A} \cdot \sinh(1.24 \cdot 3\text{m})$$



Impedance & Admittance ↗

6) Admittance using Characteristic Impedance (LTL) ↗

fx
$$Y = \frac{Z}{Z_0^2}$$

[Open Calculator ↗](#)

ex
$$0.025001S = \frac{60\Omega}{(48.989\Omega)^2}$$

7) Admittance using Propagation Constant (LTL) ↗

fx
$$Y = \frac{\gamma^2}{Z}$$

[Open Calculator ↗](#)

ex
$$0.025627S = \frac{(1.24)^2}{60\Omega}$$

8) Capacitance using Surge Impedance (LTL) ↗

fx
$$C_{\text{Farad}} = \frac{L_{\text{Henry}}}{Z_s^2}$$

[Open Calculator ↗](#)

ex
$$13.06122F = \frac{40H}{(1.75\Omega)^2}$$



9) Characteristic Impedance (LTL) ↗

fx $Z_0 = \sqrt{\frac{Z}{Y}}$

Open Calculator ↗

ex $48.98979\Omega = \sqrt{\frac{60\Omega}{0.025S}}$

10) Characteristic Impedance using B Parameter (LTL) ↗

fx $Z_0 = \frac{B}{\sinh(\gamma \cdot L)}$

Open Calculator ↗

ex $50.92124\Omega = \frac{1050\Omega}{\sinh(1.24 \cdot 3m)}$

11) Characteristic Impedance using C Parameter (LTL) ↗

fx $Z_0 = \frac{1}{C} \cdot \sinh(\gamma \cdot L)$

Open Calculator ↗

ex $48.97881\Omega = \frac{1}{0.421S} \cdot \sinh(1.24 \cdot 3m)$

12) Characteristic Impedance using Sending End Current (LTL) ↗

fx $Z_0 = \frac{V_r \cdot \sinh(\gamma \cdot L)}{I_s - I_r \cdot \cosh(\gamma \cdot L)}$

Open Calculator ↗

ex $48.98901\Omega = \frac{8.88kV \cdot \sinh(1.24 \cdot 3m)}{3865.49A - 6.19A \cdot \cosh(1.24 \cdot 3m)}$



13) Characteristic Impedance using Sending End Voltage (LTL) 

$$fx \quad Z_0 = \frac{V_s - V_r \cdot \cosh(\gamma \cdot L)}{\sinh(\gamma \cdot L) \cdot I_r}$$

Open Calculator 

$$ex \quad 48.95468\Omega = \frac{189.57kV - 8.88kV \cdot \cosh(1.24 \cdot 3m)}{\sinh(1.24 \cdot 3m) \cdot 6.19A}$$

14) Impedance using Characteristic Impedance (LTL) 

$$fx \quad Z = Z_0^2 \cdot Y$$

Open Calculator 

$$ex \quad 59.99805\Omega = (48.989\Omega)^2 \cdot 0.025S$$

15) Impedance using Propagation Constant (LTL) 

$$fx \quad Z = \frac{\gamma^2}{Y}$$

Open Calculator 

$$ex \quad 61.504\Omega = \frac{(1.24)^2}{0.025S}$$

16) Inductance using Surge Impedance (LTL) 

$$fx \quad L_{Henry} = C_{Farad} \cdot Z_s^2$$

Open Calculator 

$$ex \quad 39.8125H = 13F \cdot (1.75\Omega)^2$$



17) Surge Impedance (LTL) ↗

fx $Z_S = \sqrt{\frac{L_{\text{Henry}}}{C_{\text{Farad}}}}$

[Open Calculator ↗](#)

ex $1.754116\Omega = \sqrt{\frac{40\text{H}}{13\text{F}}}$

Line Parameters ↗**18) Length using A Parameter (LTL)** ↗

fx $L = a \frac{\cosh(A)}{\gamma}$

[Open Calculator ↗](#)

ex $3.002175\text{m} = a \frac{\cosh(20.7)}{1.24}$

19) Length using B Parameter (LTL) ↗

fx $L = a \frac{\sinh\left(\frac{B}{Z_0}\right)}{\gamma}$

[Open Calculator ↗](#)

ex $3.031162\text{m} = a \frac{\sinh\left(\frac{1050\Omega}{48.989\Omega}\right)}{1.24}$



20) Length using C Parameter (LTL) ↗

$$fx \quad L = a \frac{\sinh(C \cdot Z_0)}{\gamma}$$

[Open Calculator ↗](#)

$$ex \quad 3.000168m = a \frac{\sinh(0.421S \cdot 48.989\Omega)}{1.24}$$

21) Length using D Parameter (LTL) ↗

$$fx \quad L = a \frac{\cosh(D)}{\gamma}$$

[Open Calculator ↗](#)

$$ex \quad 3m = a \frac{\cosh(14.59)}{1.24}$$

22) Propagation Constant (LTL) ↗

$$fx \quad \gamma = \sqrt{Y \cdot Z}$$

[Open Calculator ↗](#)

$$ex \quad 1.224745 = \sqrt{0.025S \cdot 60\Omega}$$

23) Propagation Constant using A Parameter (LTL) ↗

$$fx \quad \gamma = a \frac{\cosh(A)}{L}$$

[Open Calculator ↗](#)

$$ex \quad 1.240899 = a \frac{\cosh(20.7)}{3m}$$



24) Propagation Constant using B Parameter (LTL) ↗

$$\gamma = a \frac{\sinh\left(\frac{B}{Z_0}\right)}{L}$$

[Open Calculator ↗](#)

ex $1.25288 = a \frac{\sinh\left(\frac{1050\Omega}{48.989\Omega}\right)}{3m}$

25) Propagation Constant using C Parameter (LTL) ↗

$$\gamma = a \frac{\sinh(C \cdot Z_0)}{L}$$

[Open Calculator ↗](#)

ex $1.240069 = a \frac{\sinh(0.421S \cdot 48.989\Omega)}{3m}$

26) Propagation Constant using D Parameter (LTL) ↗

$$\gamma = a \frac{\cosh(D)}{L}$$

[Open Calculator ↗](#)

ex $1.124102 = a \frac{\cosh(14.59)}{3m}$



Variables Used

- **A** A Parameter
- **B** B Parameter (*Ohm*)
- **C** C Parameter (*Siemens*)
- **C_{Farad}** Capacitance (*Farad*)
- **D** D Parameter
- **I_r** Receiving End Current (*Ampere*)
- **I_s** Sending End Current (*Ampere*)
- **L** Length (*Meter*)
- **L_{Henry}** Inductance (*Henry*)
- **V_r** Receiving End Voltage (*Kilovolt*)
- **V_s** Sending End Voltage (*Kilovolt*)
- **Y** Admittance (*Siemens*)
- **Z** Impedance (*Ohm*)
- **Z₀** Characteristic Impedance (*Ohm*)
- **Z_s** Surge Impedance (*Ohm*)
- **γ** Propagation Constant



Constants, Functions, Measurements used

- **Function:** **acosh**, acosh(Number)
Inverse hyperbolic cosine function
- **Function:** **asinh**, asinh(Number)
Inverse hyperbolic sine function
- **Function:** **cosh**, cosh(Number)
Hyperbolic cosine function
- **Function:** **sinh**, sinh(Number)
Hyperbolic sine function
- **Function:** **sqrt**, sqrt(Number)
Square root function
- **Measurement:** **Length** in Meter (m)
Length Unit Conversion 
- **Measurement:** **Electric Current** in Ampere (A)
Electric Current Unit Conversion 
- **Measurement:** **Capacitance** in Farad (F)
Capacitance Unit Conversion 
- **Measurement:** **Electric Resistance** in Ohm (Ω)
Electric Resistance Unit Conversion 
- **Measurement:** **Electric Conductance** in Siemens (S)
Electric Conductance Unit Conversion 
- **Measurement:** **Inductance** in Henry (H)
Inductance Unit Conversion 
- **Measurement:** **Electric Potential** in Kilovolt (kV)
Electric Potential Unit Conversion 



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- Long Transmission Line Formulas 
- Medium Line Formulas 
- Power Circle Diagram Formulas 
- Short Line Formulas 
- Transient Formulas 

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