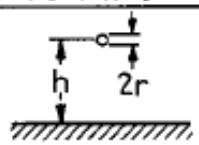
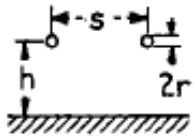
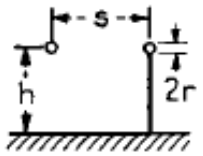
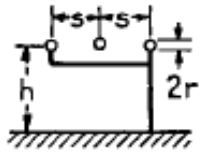
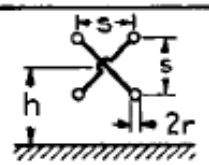
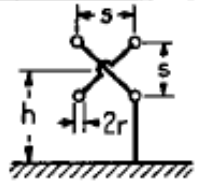
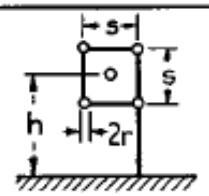
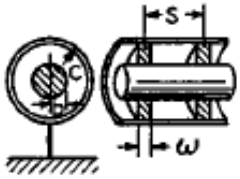
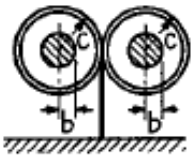
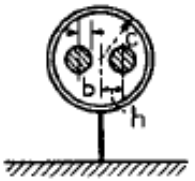
LOGARITHMS TO THE BASE 10 — I_1 = GENERATOR CURRENT

LINE CONFIGURATION		CHARACTERISTIC IMPEDANCE	NET GROUND-RETURN CURRENT
Single wire		$Z_0 = 138 \operatorname{Log} \frac{2h}{r}$	$I_{Gnd} = I_1$
2-Wire balanced		$Z_0 = 276 \operatorname{Log} \frac{s}{r}$	$I_{Gnd} = 0$
2-Wire 1 wire grounded		$Z_0 \approx 276 \frac{\operatorname{Log} \frac{s}{r} \operatorname{Log}\left[\rho \frac{2s}{r}\right]}{\operatorname{Log}\left[\rho^2 \left(\frac{s}{r}\right)^2\right]}$ $\rho = \frac{2h}{s}$	$I_{Gnd} \approx I_1 \frac{\operatorname{Log} \frac{s}{r}}{\operatorname{Log} \frac{2h}{r}}$
3-Wire 2 wires grounded		$Z_0 \approx 69 \left[\operatorname{Log} \frac{s^3}{2r^3} - \frac{\left(\operatorname{Log} \frac{s}{2r}\right)^2}{\operatorname{Log} \frac{2h^2}{rs}}\right]$ $\rho = \frac{2h}{s}$	$I_{Gnd} \approx I_1 \frac{\operatorname{Log} \frac{s}{2r}}{\operatorname{Log} \frac{s\rho^2}{2r}}$
4-Wire balanced		$Z_0 = 138 \left(\operatorname{Log} \frac{s}{r}\right) - 21$	$I_{Gnd} = 0$
4-Wire 2-wires grounded		$Z_0 \approx 138 \left[\frac{\operatorname{Log} \frac{s}{r\sqrt{2}} \operatorname{Log}\left[\rho^4 \frac{s}{r\sqrt{2}}\right]}{\operatorname{Log}\left[\rho^4 \left(\frac{s}{r\sqrt{2}}\right)^2\right]}\right]$ $\rho = \frac{2h}{s}$	$I_{Gnd} \approx I_1 \frac{\operatorname{Log} \frac{s}{r\sqrt{2}}}{\operatorname{Log} \frac{\rho^2 s}{r\sqrt{2}}}$
5- Wire 4 wires grounded		$Z_0 \approx 138 \left[\operatorname{Log} \frac{2h}{r} - \frac{\left[\operatorname{Log} 2\rho^2\right]^2}{\operatorname{Log}\left[\rho^3 \frac{h\sqrt{2}}{r}\right]}\right]$ $\rho \frac{2h}{s}$	$I_{Gnd} \approx I_1 \frac{\operatorname{Log} \frac{s}{r4\sqrt{2}}}{\operatorname{Log} \frac{s\rho^4}{r\sqrt{2}}}$
Concentric (coaxial)		$Z_0 = 138 \frac{\operatorname{Log} \frac{c}{b}}{\sqrt{1 + \frac{(\varepsilon - 1)\omega}{s}}}$ ε = Dielectric constant of insulating material	
Double coaxial balanced		$Z_0 = 276 \frac{\operatorname{Log} \frac{c}{b}}{\sqrt{1 + \frac{(\varepsilon - 1)\omega}{s}}}$	
Shielded pair balanced		$Z_0 = \frac{120}{\sqrt{\varepsilon}} \left[2.303 \operatorname{Log}\left(2v \frac{1-\sigma^2}{1+\sigma^2}\right) - \frac{1+4v^2}{16v^4}\left(1 - 4\sigma^2\right)\right]$ ε = Dieletric constant of medium ε = Unity for gaseous medium $v = \frac{h}{b}$; $\sigma = \frac{h}{c}$	