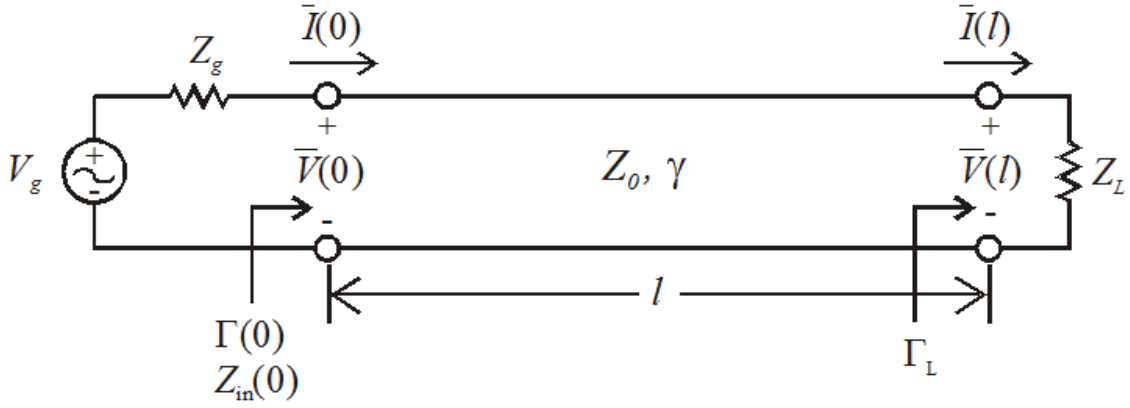
A 45 – *j*50 Ω load is connected to the end of a 460 cm long lossy transmission line (γ = 0.047 + *j* 13.88 m^{-1} and Z_0 = 54.65 – *j* 0.1 Ω) that is driven by a 400 MHz source where $v_g(t) = 100\cos(\omega t)$ V and $Z_g = 50 + j5\ \Omega$, determine (a) the input impedance, input reflection coefficient, input voltage, input current, and time-average power delivered to the line. (b) Find the load voltage, load current, and time-average power delivered to the load.



Given:

Vg := 100·e^(j·0) V Zg := 50 + j·5 Ω ZL := 45 – j·50 Ω

l := 4.6 m γ := 0.047 + j·13.88 1/m Z0 := 54.65 – j·0.1 Ω

a) Input impedance, reflection coefficient, voltage, current, and time-average power delivered to the line.

$\Gamma L := \frac{ZL - Z0}{ZL + Z0}$ $|\Gamma L| = 0.45568$ $\arg(\Gamma L)\cdot\frac{180}{\pi} = -74.2537$ deg

$\Gamma 0 := \Gamma L\cdot e^{-2\cdot\gamma\cdot l}$ $|\Gamma 0| = 0.29571$ $\arg(\Gamma 0)\cdot\frac{180}{\pi} = 169.3044$ deg

$Zin0 := Z0\cdot\frac{(1+\Gamma 0)}{(1-\Gamma 0)}$ Zin0 = 29.89453 + 3.54029i Ω

$I0 := \frac{Vg}{Zg + Zin0}$ $|I0| = 1.2446$ A $\arg(I0)\cdot\frac{180}{\pi} = -6.1014$ deg

$V0 := \frac{Vg\cdot Zin0}{Zg + Zin0}$ $|V0| = 37.4655$ V $\arg(V0)\cdot\frac{180}{\pi} = 0.6524$ deg

Power into trans. line $P0 := 0.5\cdot Re(V0\cdot\overline{I0})$ $P0 = 23.15226$ W

b) Load voltage, current, time-average power delivered to the load.

$V0\_fwd := \frac{V0}{1 + \Gamma 0}$ $V0\_fwd = 52.53989 - 3.46321i$ V

$VL := V0\_fwd\cdot e^{-\gamma\cdot l}\cdot(1 + \Gamma L)$ $|VL| = 51.1638$ V $\arg(VL)\cdot\frac{180}{\pi} = -83.314$ deg

$IL := \frac{V0\_fwd}{Z0}\cdot e^{-\gamma\cdot l}\cdot(1 - \Gamma L)$ $|IL| = 0.7606$ A $\arg(IL)\cdot\frac{180}{\pi} = -35.301$ deg

Power delivered to load- $PL := 0.5\cdot Re(VL\cdot\overline{IL})$ $PL = 13.0164$ W