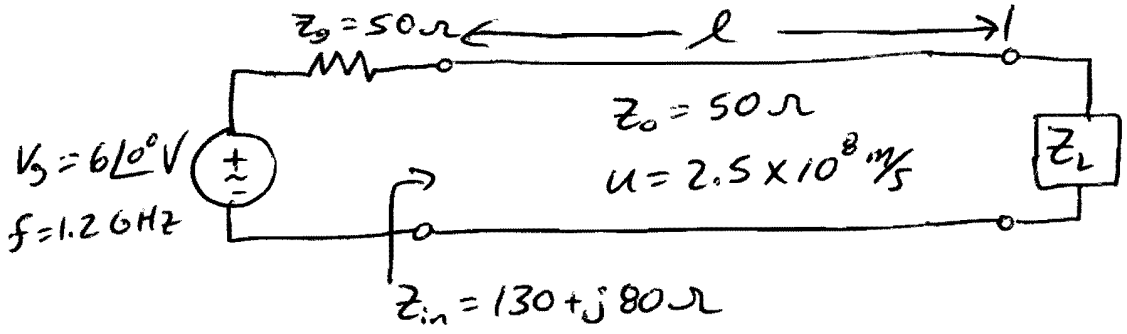
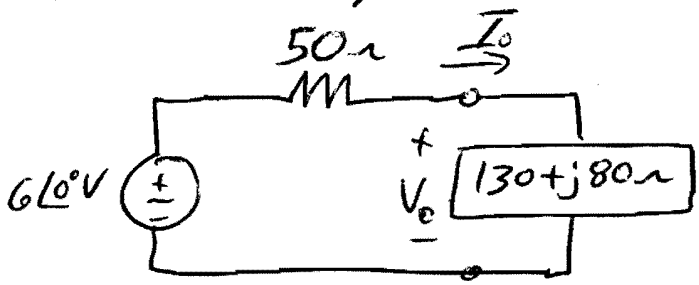
A lossless transmission line (Z_0 = 50 Ω, $u = 2.5 \times 10^8$ m/s), terminated with an unknown load, has an input impedance of 130 + *j*80 Ω. The transmission line is connected to a 50 Ω generator operating at 1.2 GHz with phasor voltage $V_g = 6\angle 0°$ V. First, sketch the transmission line circuit. Then, determine (a) the phase constant β, (b) phasor input current I_0 & voltage V_0, and (c) phasor forward V_0^+ & backward V_0^- voltage waves.



a) (11.21) $\beta = \dfrac{\omega}{u} = \dfrac{2\pi(1.2\times10^9)}{2.5\times10^8} = 30.1593$ rad/m

b) Phasor Equiv. Circuit



$$I_0 = \frac{6\angle 0°}{50+(130+j80)} = 0.03046\angle -23.9625° \text{ A}$$

$$V_0 = (6\angle 0°)\frac{130+j80}{50+(130+j80)} = 4.6496\angle 7.645° \text{ V}$$

c) $V_0^+ = \frac{1}{2}[V_0 + I_0 Z_0] = \frac{1}{2}[4.65\angle 7.645° + (0.0305\angle -23.96°)(50)]$

$V_0^+ = 3\angle 0° \text{ V}$

$V_0^- = V_0 - V_0^+ = \frac{1}{2}[V_0 - I_0 Z_0] = 1.723\angle 21.04° \text{ V}$