

# University of Portland School of Engineering

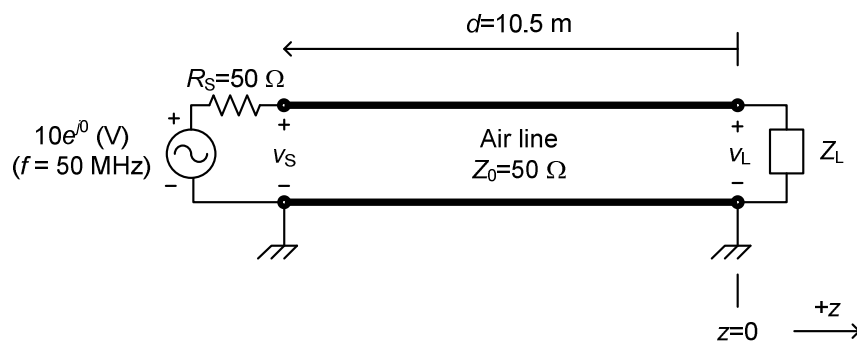
EE 301  
Spring 2012  
A.Inan

## Homework # 5–Sinusoidal Steady-State (SSS) Waves on Transmission Lines

(Assigned: Friday, March 9, 2012)

(Due: Wednesday, March 21, 2012, 11:25a.m.)

- (1) A  $50 \Omega$ , 10.5 m long air transmission line terminated with a load impedance of  $Z_L=70+j10 \Omega$  is excited by a sinusoidal voltage source, as shown.



Calculate the following:

- (a) The load reflection coefficient  $\Gamma_L$ .
- (b) The standing wave ratio  $S$  on the line.
- (c) Find all the  $V_{\max}$  and  $V_{\min}$  positions (in actual lengths) on the line and present your results in a table form.
- (d) Find the input impedance  $Z_{\text{in}}$  seen at each  $V_{\max}$  and  $V_{\min}$  position.
- (e) Find the input impedance  $Z_{\text{in}}$  seen at the source end of the line and draw the equivalent lumped circuit with respect to the source end.
- (f) Find the phasor voltages  $V_S$ ,  $V^+$ ,  $V^-$ , and  $V_L$ .
- (g) Find the  $V_{\max}$  and  $V_{\min}$  values.
- (h) Find the time-average powers  $P^+$ ,  $P^-$ ,  $P_{RS}$ ,  $P_L$ , and  $P_{\text{source}}$ . What percentage of the power carried by the incident wave reflects back to the source?
- (i) (Optional) Find the positions on the line where  $Z_{\text{in}}=Z_0+jX_{\text{in}}$ . Find  $X_{\text{in}}$  values at these positions.
- (j) (Optional) Find the  $I_{\max}$  and  $I_{\min}$  positions on the line.
- (k) (Optional) Find the  $I_{\max}$  and  $I_{\min}$  values.
- (l) Repeat all the above calculations for a load impedance of  $Z_L=15-j35 \Omega$ .

### An Important Reminder Note:

EE 301-Midterm # 2 is scheduled to be given on Wednesday, April 18, 2012! ☹  
(It will be in-class closed-book exam. Two formula sheets will be allowed.)