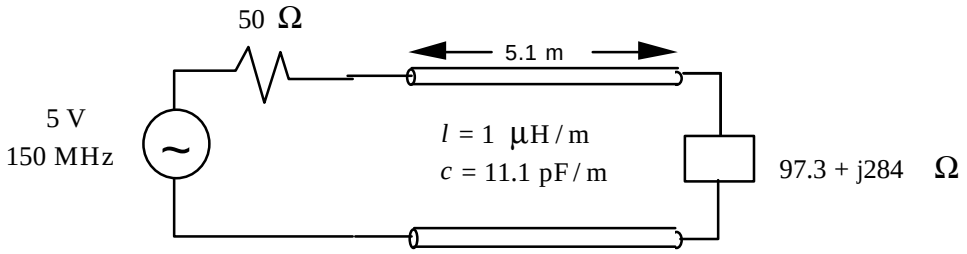
Transmission line matching & Smith charts

Reading assignment

Popović and Popović, Chapter 18.6

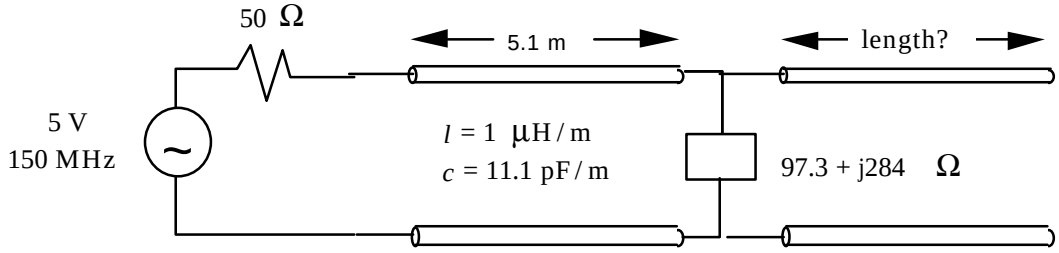
Problem 1 - Matching a complex load

The following transmission line problem has a complex load as is often encountered in antenna applications. Assume the transmission line is lossless.



a. Find the reflection coefficient.

b. Determine the standing wave ratio on the transmission line.



c. A second transmission line can be added in parallel to the load to give a total impedance that is real. What Z_{line} in parallel with the load gives a total impedance that is real? (Hint: Use admittances $Y = 1/Z$).

d. Determine the length of open-circuited transmission line that gives the desired Z_{line}.

e. Calculate the new reflection coefficient and standing wave ratio for the modified load. Compare with the answers to part a. and b.

Problem 2 - Smith chart

Unmodified load

a. Find the normalized impedance of the unmodified load of Problem 1a and locate it on the Smith chart.

b. Determine the reflection coefficient of the unmodified load.

Modified load

c. In Problem 1c and 1d, you determined that an open circuited transmission line with $Z_{line} = -317.3j$ could be used to reduce reflections. Locate the position on the Smith chart of the open circuit load and Z_{line}. Use the Smith chart to find the length of transmission line needed to create Z_{line}.

d. Locate the modified load on the Smith chart. Then use the Smith chart to determine $Z_{in}(z=0)$.