Waves on Transmission Lines

After completing this section, students should be able to do the following.

- Name several transmission lines.
- Explain the difference between phase shift and time delay of a sinusoidal signal.
- Evaluate whether the transmission line theory or circuit theory has to be used based on the length of the line and the frequency
- Students will explain the difference between lumped and distributed circuit elements.
- Derive the voltage on a transmission line from a consideration of a time-delay due to the finite speed of signals in a transmission-line circuit.
- Explain parts of propagation constant and what they represent.
- Calculate the phase and attenuation constant for specific transmission lines.
- Identify whether the wave travels in the positive or negative direction from the equation of a wave.
- Describe how signal flows on a transmission line
- Recognize and explain transmission line equivalent circuit model
- Derive the equations for voltage and current waves on a transmission line from the equivalent circuit model.
- Describe forward and reflected wave on a transmission line.
- Sketch forward and reflected wave as a function of distance, and explain how the graph changes as time passes.
- Derive phasor form of voltage and current wave from/to the time-domain form.
- Describe what wavelength represents on a graph of a wave vs. distance
- Explain how the wavelength is similar and different to waves period?

Learning outcomes:
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- Derive and calculate the transmission line impedance and reflection coefficient.
- Relate reflection coefficient to impedance.
- Derive and calculate the input impedance of a transmission line
- Calculate and visualize phasors of forward going voltage and current waves at various points on a transmission line.