

TRANSMISSION Lines - Steady State Excitation

- Before, we dealt with edges followed by long duration DC levels, then another edge. ↪
 - Now we work with continuously varying excitation
 - More difficult to visualize
 - More difficult to determine behavior
 - We launched edges into a T-line seeing nothing but Z_0 as we had a "quiet" line.
 - Now with continuous excitation, we already have the reflection(s) at the line input.
 - Our driver sees the summation of previous reflected waves with the incoming wave, both of which are continuously changing, but when summed, result in stationary waveform called a standing wave.
 - The standing wave results from the summation of forward & reflected waves.
 - The standing wave can only exist when reflections are present.
 - Reflections still occur at impedance boundaries.
 - Without linearity we could not simply sum individual waves.
- (the transient case, followed by the DC steady state case)

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In the steady-state case, the standing wave is the only voltage or current along the T-line.

The standing wave oscillates in instantaneous magnitude but does not move up & down the line.

See: <http://www.rfmentor.com/note/60>

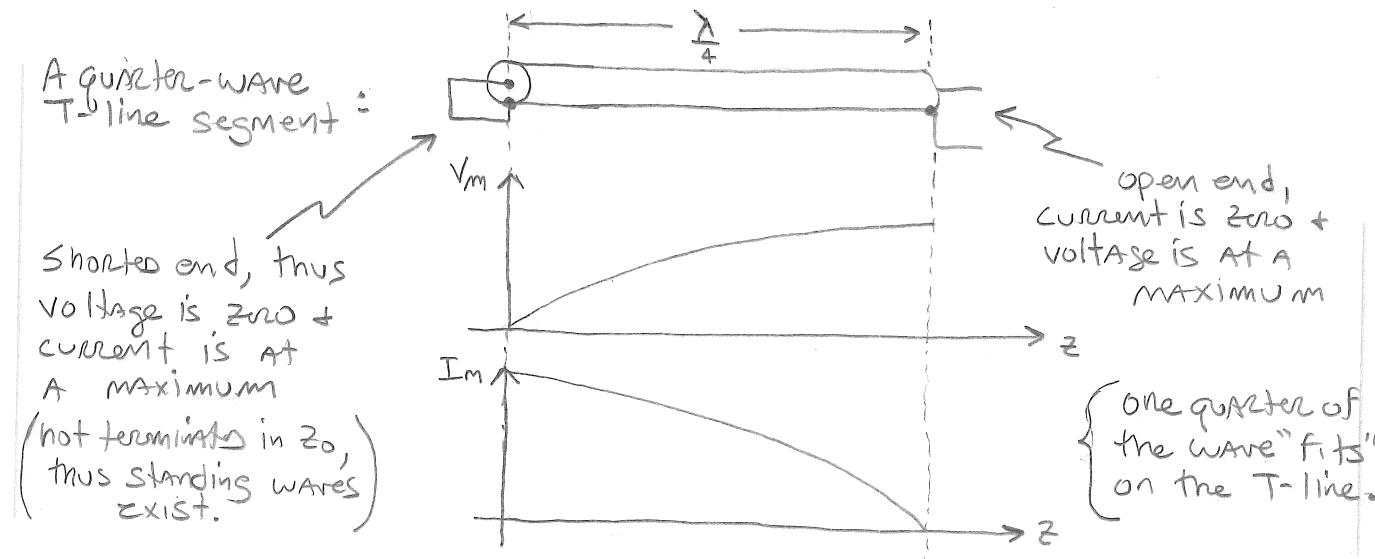
When standing waves exist, there are points of maximum & minimum magnitude. These points don't move. They are fixed in position by:

- electrical length of the line
- frequency of the signal

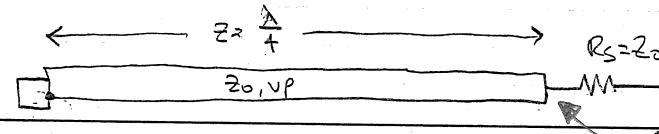
The variation between the maximum and minimum of the standing wave is determined by the mismatch between Z_0 & the load impedance.

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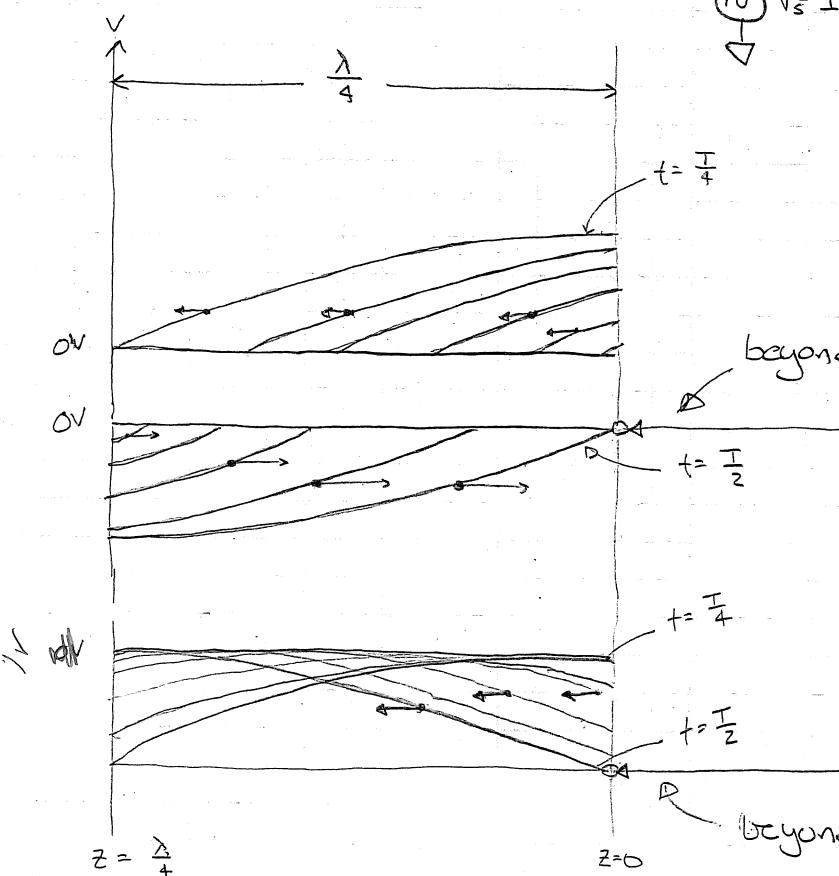
Because T-Lines can support standing waves and the position of those waves are fixed, a T-Line exhibits resonance at frequencies determined by its electrical length.



3a

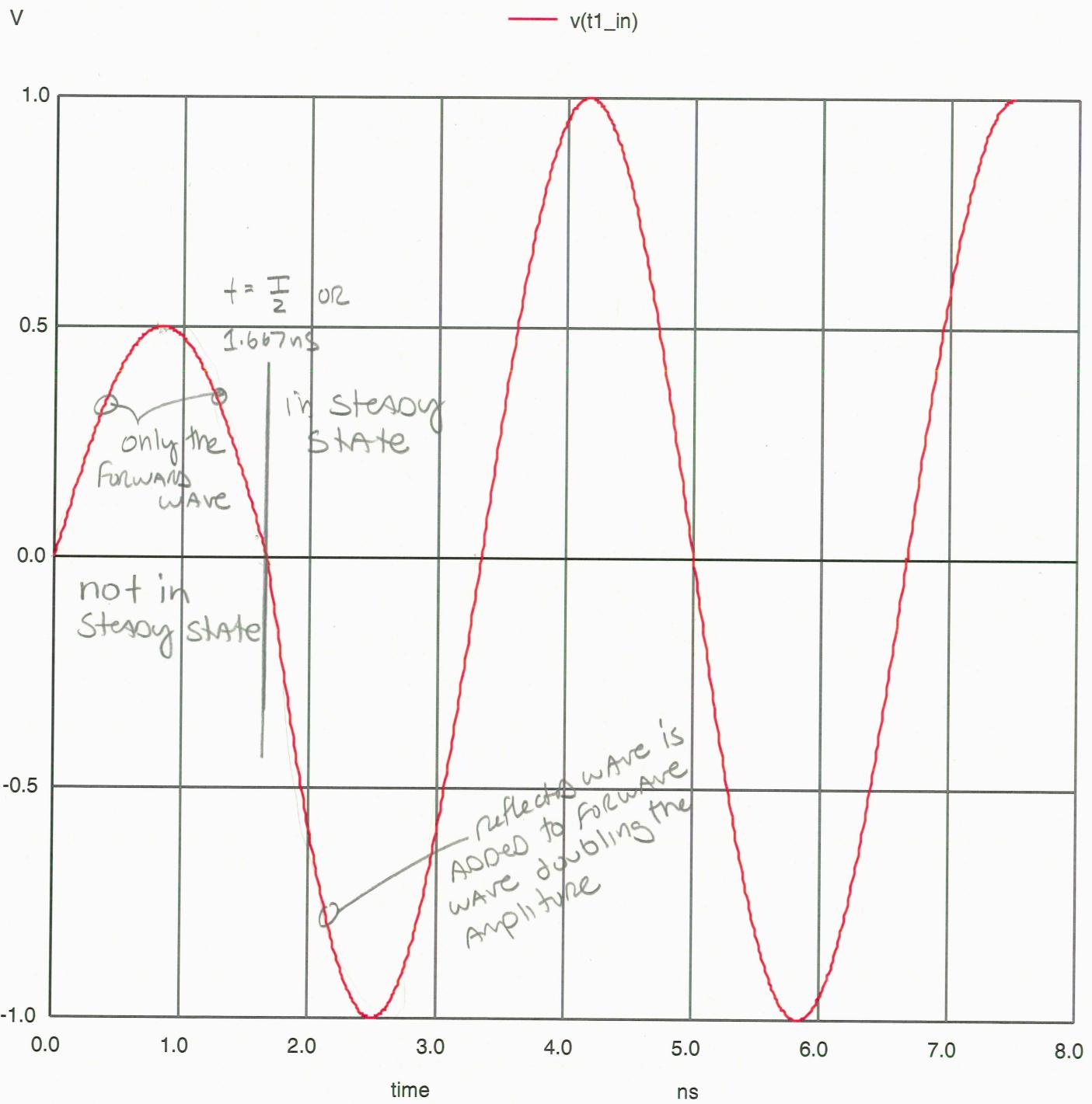
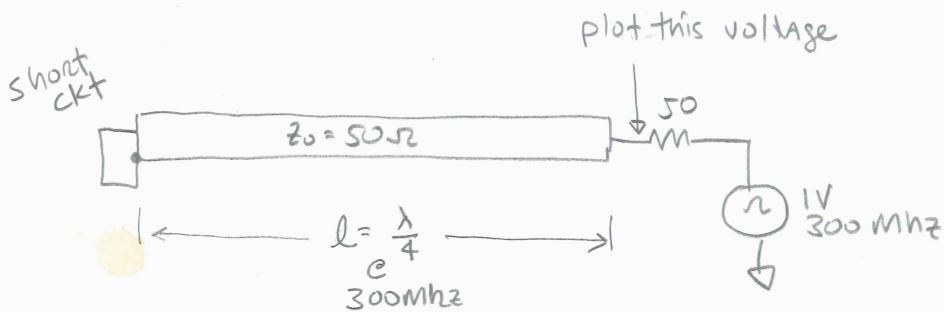


insight into $\frac{\lambda}{4}$ behavior

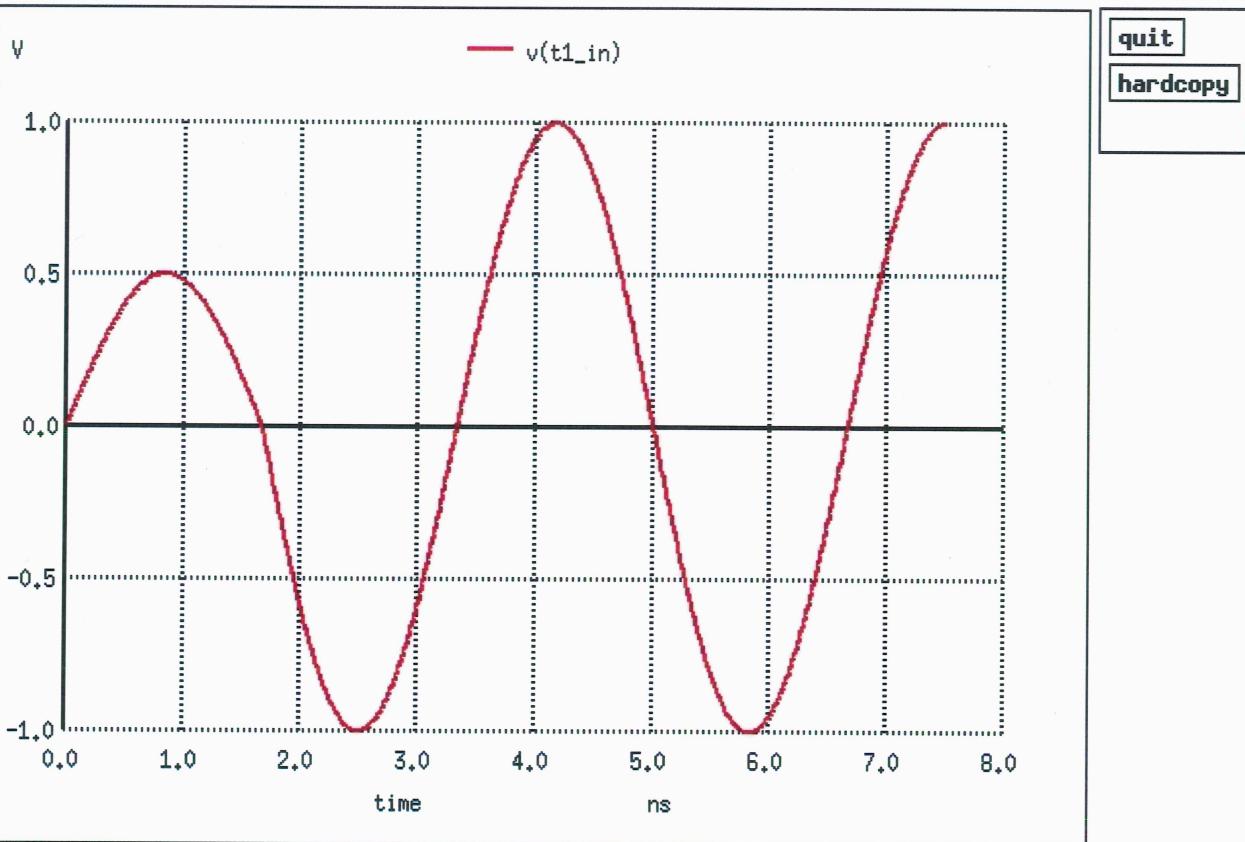


After $\frac{\lambda}{2}$, reflected and forward waves ADD constructively so that the total voltage at the source end of the line is equal in amplitude to the source voltage $\therefore I_{in} = 0$.

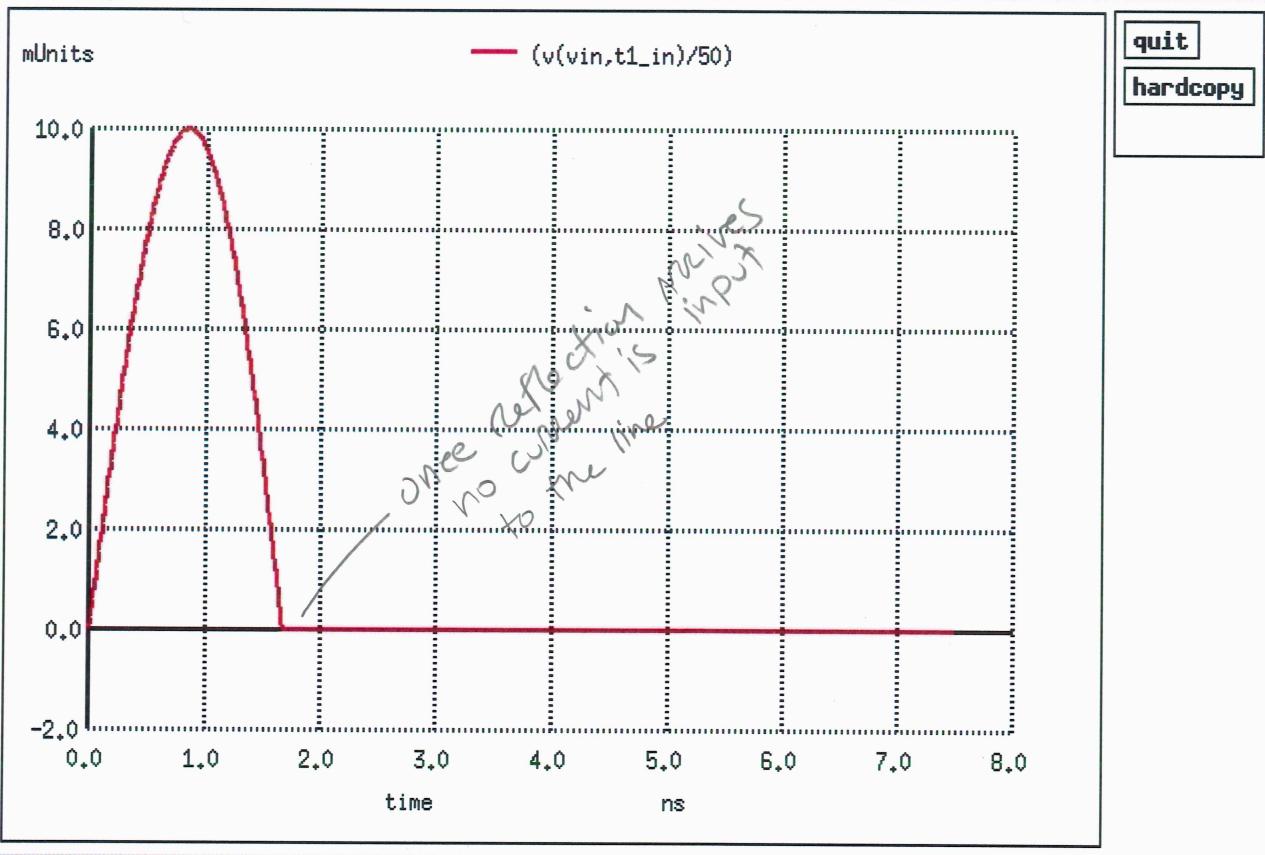
3a



tran1: quarterwave line shorted at far end

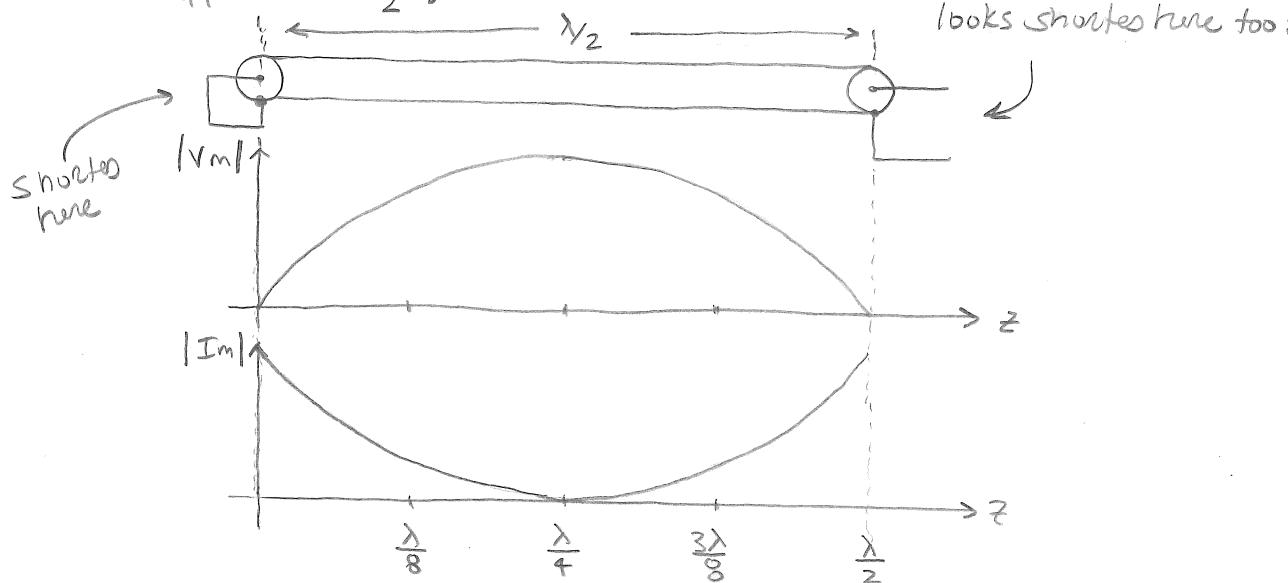


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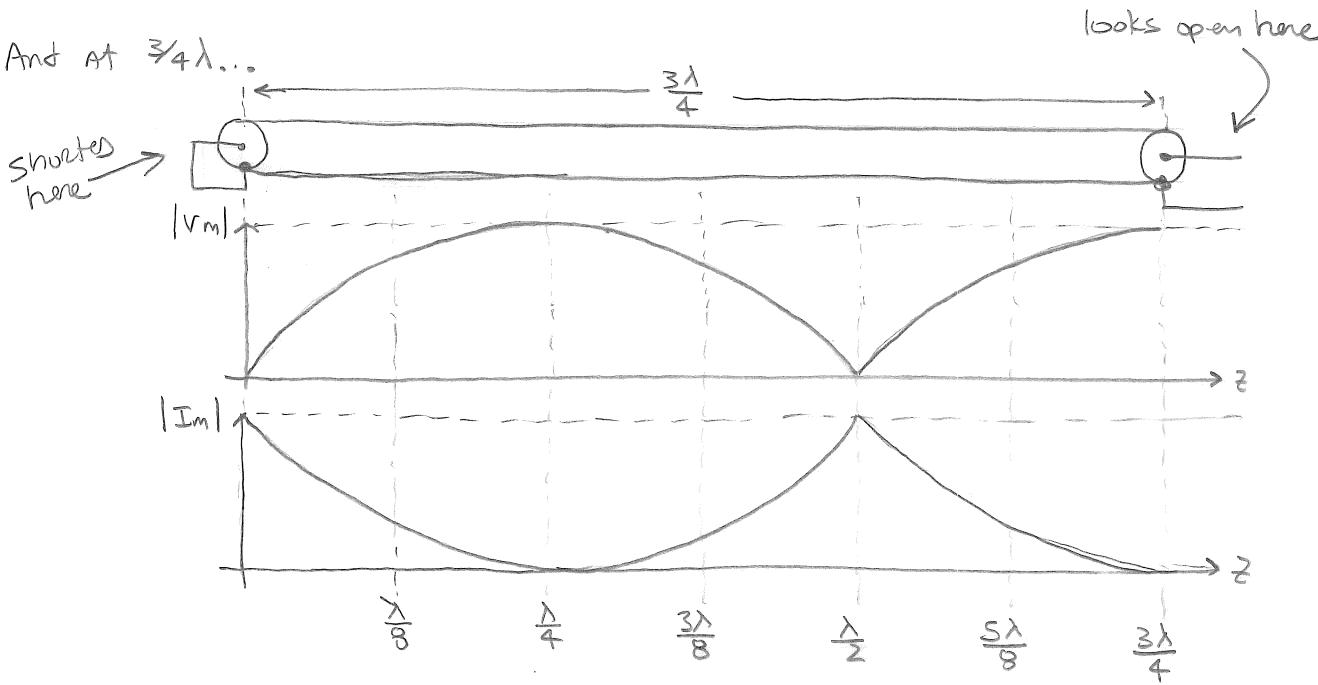
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What happens at $\frac{\lambda}{2}$?



this could be helpful in determining an impedance at a distance.

And at $\frac{3}{4}\lambda$...



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A summary of the graphs:

- At odd λ_0 lengths A shorted T-line looks open at the other end.

open " " shorted " " " "

- At multiples of $\lambda_0/2$, A T-Line presents the impedance at the other end,