Example- Illustrate forward and backward wave propagation for a lossless transmission line (based on Belden 9085).

From earlier example

$f := 100 \cdot 10^6$ Hz $\quad \omega := 2 \cdot \pi \cdot f \quad \omega = 6.283 \times 10^8$ rad/s

$R := 0$ Ω/m $\quad L := 1.25311 \cdot 10^{-6}$ H/m

$G := 0$ S/m $\quad C := 1.39135 \cdot 10^{-11}$ F/m

Calculate a few parameters

Propagation constant (11.11)/(11.21a)

$\gamma := \sqrt{(R + j \cdot \omega \cdot L) \cdot (G + j \cdot \omega \cdot C)}$ $\quad \gamma = 2.62357i$ 1/m

Attenuation constant $\alpha := 0$ $\quad \alpha = 0$ Np/m

$\alpha\_dB := 20 \cdot \log(\exp(\alpha))$ $\quad \alpha\_dB = 0$ dB/m

Phase constant (11.21a) $\beta := \omega \cdot \sqrt{L \cdot C}$ $\quad \beta = 2.62357$ rad/m

Wavelength (11.13) $\lambda := \frac{2 \cdot \pi}{\beta}$ $\quad \lambda = 2.3949$ m

Phase velocity (11.21b) $u := \frac{1}{\sqrt{L \cdot C}}$ $\quad u = 2.3949 \times 10^8$ m/s

Characteristic Impedance (11.21c) $Z0 := \sqrt{\frac{L}{C}}$ $\quad Z0 = 300.10719$ Ω

Note: Most of these parameters changed very little from the lossy case. This makes sense as the Belden 9085 twin-lead is very lowloss at 100 MHxz.

Define some constants for the forward & backward propagating voltage waves

Vplus := 1 V Vminus := 1 V $T := \frac{2\pi}{\omega}$ $T = 1 \times 10^{-8}$ s

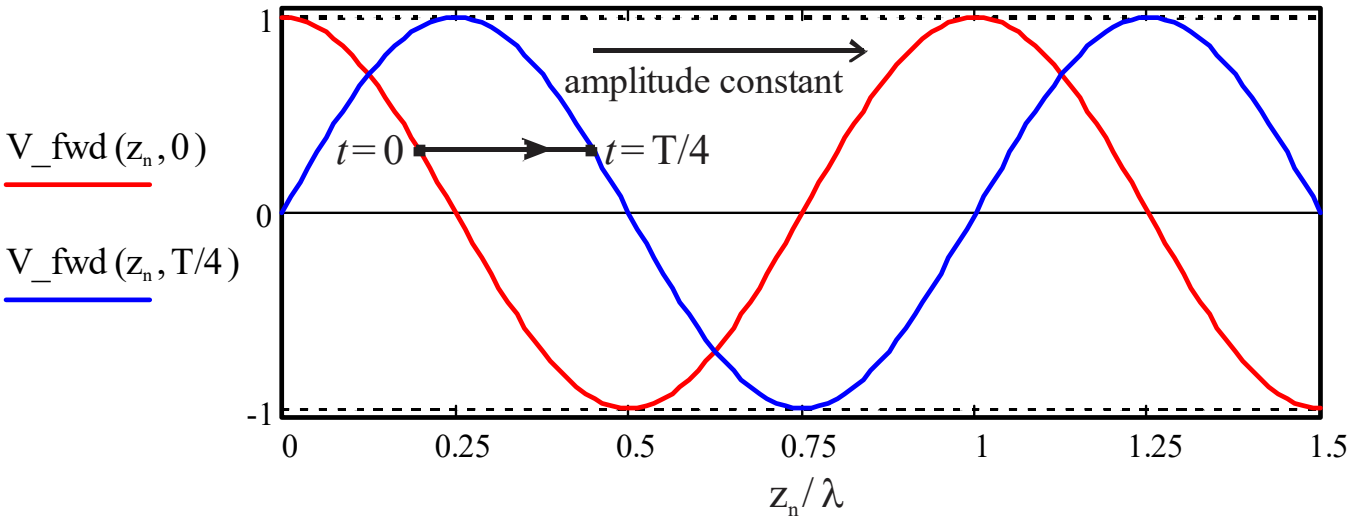
Define functions for forward and backward components of the voltage wave

$V\_fwd(z,t) := Vplus \cdot \cos(\omega \cdot t - \beta \cdot z)$

$n := 0 .. 120$ $z_n := \frac{1.5 \cdot \lambda \cdot n}{120}$

$V\_bwd(z,t) := Vminus \cdot \cos(\omega \cdot t + \beta \cdot z)$

Forward Traveling Voltage wave



Backward Traveling Voltage wave