Rope wave reflections (cont.)

Because ring is massless, force applied to it must always be zero (or infinitesimal) to avoid $\infty$ acceleration $\Rightarrow \frac{\partial v}{\partial x} = 0$ at ring.
$\Rightarrow$ situation is equivalent to:

⇒ reflected pulse is non-inverted:

Intermediate case:

Analogous problem for transmission lines:

What are the reflected and transmitted waves in terms of the incident wave?

Boundary conditions:

$[ V_i = V_t ]_{x=0}$
incident transmitted

$x = 0$

$V_{R1} \equiv$ right-moving wave in medium 1 (incident wave)

$V_{L1} \equiv$ left-moving wave in medium 1 (reflected wave)

$V_{R2} \equiv$ right-moving wave in medium 2 (transmitted wave)

Boundary conditions $\Rightarrow$

\[
\begin{align*}
- & \quad \left[ I_{\text{reflected}} = I_{\text{incident}} \frac{Z_i - Z_t}{Z_i + Z_t} \right]_{x=0} \\
& \quad \left[ I_{\text{transmitted}} = I_{\text{incident}} \frac{Z_i}{Z_i + Z_t} \right]_{x=0}
\end{align*}
\]

Where $Z \equiv \frac{V}{I}$ for right-moving wave $Z = \frac{V}{I}$ for left-moving wave $Z = \frac{V_l}{I}$.
Waves at interfaces on transmission lines (cont.)

\[
\begin{align*}
V_{\text{reflected}} &= V_{\text{incident}} \frac{Z_t - Z_i}{Z_t + Z_i} \\
V_{\text{transmitted}} &= V_{\text{incident}} \frac{2Z_t}{Z_t + Z_i}
\end{align*}
\]