$$v_I = \sqrt{\frac{T}{\mu_I}} = \frac{\omega}{k_I}$$

$$k_I = \omega\sqrt{\frac{\mu_I}{T}}$$

$$k_{II} = \omega\sqrt{\frac{\mu_{II}}{T}}$$

$$y_i(x,t) = A_i\ \sin(k_I x - \omega t)$$

$$y(x,t) = A_i\ \sin\left(\omega[t - \frac{1}{v_I}x]\right)$$

$$y_r(x,t) = A_r\ \sin(k_I x + \omega t)$$

$$y_t(x,t) = A_t\ \sin(k_{II} x - \omega t)$$

$$y_i\ +\ y_r = y_t$$

$$v_{yi}\ +\ v_{yr} = v_{yt}$$

$$A_i\ \sin(0 - \omega t)\ +\ A_r\ \sin(0 + \omega t) = A_t\ \sin(0 - \omega t)$$

$$-A_i\ +\ A_r = -A_t$$

$$A_i = A_r\ +\ A_t$$

$$-\omega A_i\ \cos(0 - \omega t)\ +\ \omega A_r\ \cos(0 + \omega t) = -\omega A_t\ \cos(0 - \omega t)$$

$$-A_i\ +\ A_r = -A_t$$

$$\frac{\partial y_i}{\partial x}\ +\ \frac{\partial y_r}{\partial x} = \frac{\partial y_t}{\partial x}$$

$$k_I A_i\ \cos(0 - \omega t)\ +\ k_I A_r\ \cos(0 + \omega t) = k_{II} A_t\ \cos(0 - \omega t)$$

$$k_I A_i\ +\ k_I A_r = k_{II} A_t$$

$$
\begin{aligned}
A_t &= \left(\frac{2k_I}{k_I + k_{II}}\right) A_i \\
A_r &= \left(\frac{k_{II} - k_I}{k_I + k_{II}}\right) A_i \\
y_r &= A_i \sin(k_I x + \omega t)
\end{aligned}
$$