Reflection of a wave on a string (Problem 15-40)

$A := 1$ $\quad k_1 := \frac{2\cdot\pi}{0.2} = 31.416$ $\quad k_2 := \frac{2\cdot\pi}{0.1} = 62.832$ $\quad T := 0.1$ $\quad \omega := \frac{2\cdot\pi}{T} = 62.832$

$v_1 := \frac{\omega}{k_1} = 2$ $\quad v_2 := \frac{\omega}{k_2} = 1$ Velocity for x<0 and for x>0

$A_R := A\cdot\left(\frac{v_2 - v_1}{v_2 + v_1}\right) = -0.333$ Reflected amplitude

$A_T := A\cdot\left(\frac{2\cdot v_2}{v_1 + v_2}\right) = 0.667$ Transmitted amplitude

$\frac{1}{v_1}\cdot A_R^{\,2} + \frac{1}{v_2}\cdot A_T^{\,2} = 0.5$

$\frac{1}{v_1}\cdot A^2 = 0.5$

This is a check that the power of the reflected plus transmitted waves is equal to the power of the incident wave. Energy is conserved!

$D(x,t) := \text{if}\left(x < 0, A\cdot\sin\left(k_1\cdot x - \omega\cdot t\right), 0\right)$ Incident wave

$D_R(x,t) := \text{if}\left(x < 0, A_R\cdot\sin\left(-k_1\cdot x - \omega\cdot t\right), 0\right)$ Reflected wave. (I use a different sign convention here compared with 15-40, so that AR is negative for the reflected wave when inverted by reflection.)

$D_T(x,t) := A_T\cdot\sin\left(k_2\cdot x - \omega\cdot t\right)$ Transmitted wave

$D_{total}(x,t) := \text{if}\left(x < 0, D(x,t) + D_R(x,t), D_T(x,t)\right)$ Total wave, for plotting

$t := \text{FRAME}\cdot 0.1\cdot T$ Time steps set up for animation of the plot