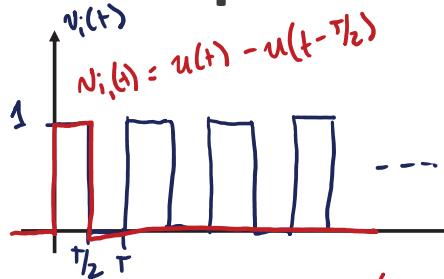


Example Problem



Laplace transform of 1st period

$$V_{I_1}(s) = \frac{1}{s} - e^{-sT/2} \frac{1}{s}$$

$$V_I(s) = \frac{V_{I_1}(s)}{1 - e^{-sT}} = \frac{1}{s} \frac{(1 - e^{-sT/2})}{1 - e^{-sT}}$$

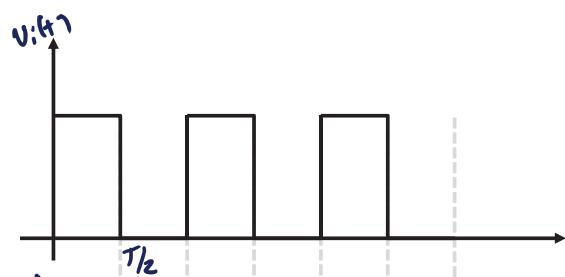
$$V_o(s) = V_I(s) H(s) = \left(\frac{R_2}{R_1} \frac{1}{1 + sCR_2} \frac{1}{s} \right) \frac{(1 - e^{-sT/2})}{(1 - e^{-sT})}$$

$$\frac{R_2}{R_1} \frac{1}{1 + sCR_2} \cdot \frac{1}{s} = \frac{\frac{R_2}{R_1}}{s} + \frac{\frac{R_2}{R_1}}{1 + sCR_2} = \frac{\frac{R_2}{R_1}}{s} + \frac{-CR_2 \frac{R_2}{R_1}}{1 + sCR_2}$$

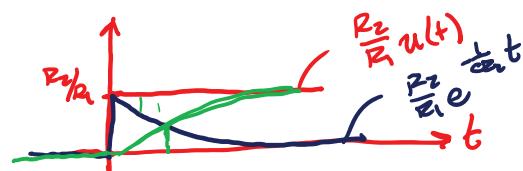
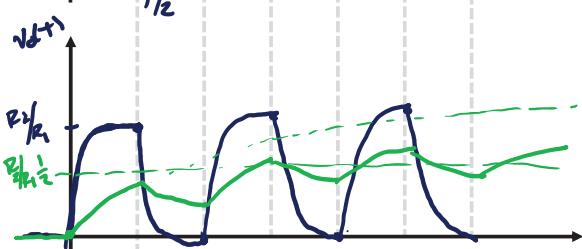
$$V_o(s) = \left[\frac{R_2/R_1}{s} - \frac{R_2/R_1}{s + CR_2} \right] \frac{(1 - e^{-sT/2})}{(1 - e^{-sT})}$$

$$v_o(t) = \sum_{k=0}^{\infty} \left[\frac{R_2}{R_1} u(t - kT) - \frac{R_2}{R_1} e^{-\frac{1}{CR_2}(t-kT)} u(t - kT) \right] - \left[\frac{R_2}{R_1} u(t - T/2 - kT) - \frac{R_2}{R_1} e^{-\frac{1}{CR_2}(t-T/2-kT)} u(t - T/2 - kT) \right]$$

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$$v_o(t) = \sum_{k=0}^{\infty} \frac{R_2}{R_1} \left(1 - e^{-\frac{1}{CR_2}(t-kT)} \right) u(t - kT) - \sum_{k=0}^{\infty} \frac{R_2}{R_1} \left(1 - e^{-\frac{1}{CR_2}(t-T/2-kT)} \right) u(t - T/2 - kT)$$



if $\frac{T}{2} \gg CR_2 \rightarrow$ go through multiple time constants of the exponential

if $\frac{T}{2} \ll CR_2 \rightarrow$ less than 1 time constant



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Block Diagrams



$$y(s) = H(s) U(s)$$

$$y(t) = \int_{-\infty}^{\infty} h(t-\tau) u(\tau) d\tau$$

$$= h(t) * u(t)$$

everything is unidirectional
no loading at output



$$y(t) = u(t) - w(t)$$

$$Y(s) = U(s) - W(s)$$

