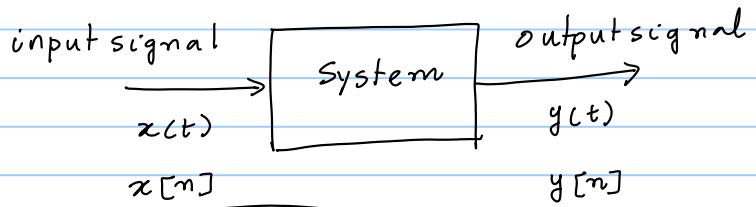
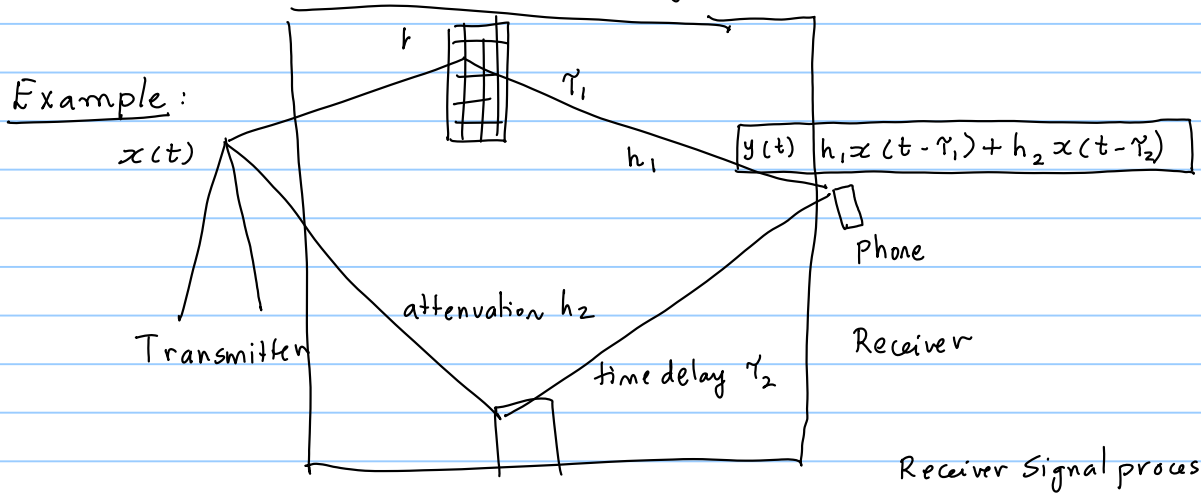
What is a system?

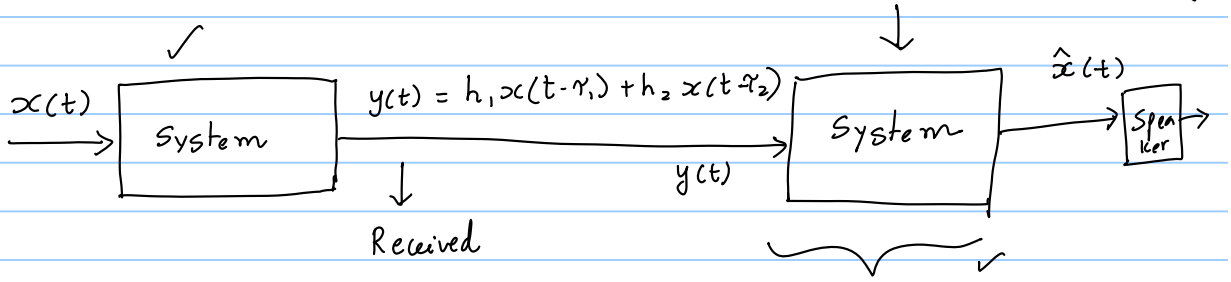
Note Title 6/25/2011



x[n] y[n]



Receiver Signal processing

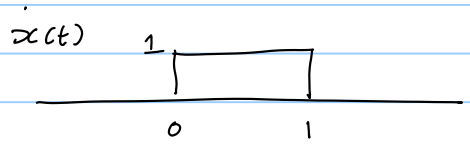


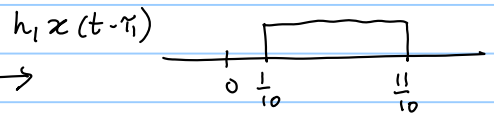
1) System Identification – Parameter identification

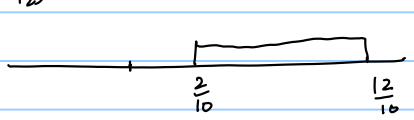
2) System Analysis – Understanding the effects of the system

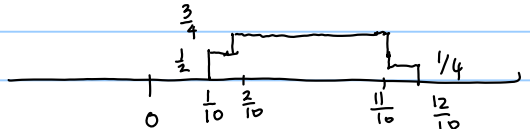
– Process y(t) or invert y(t)

$h_1 = \frac{1}{2}$ $\tau_1 = \frac{1}{10}$ sec $h_2 = \frac{1}{4}$ $\tau_2 = \frac{2}{10}$ sec

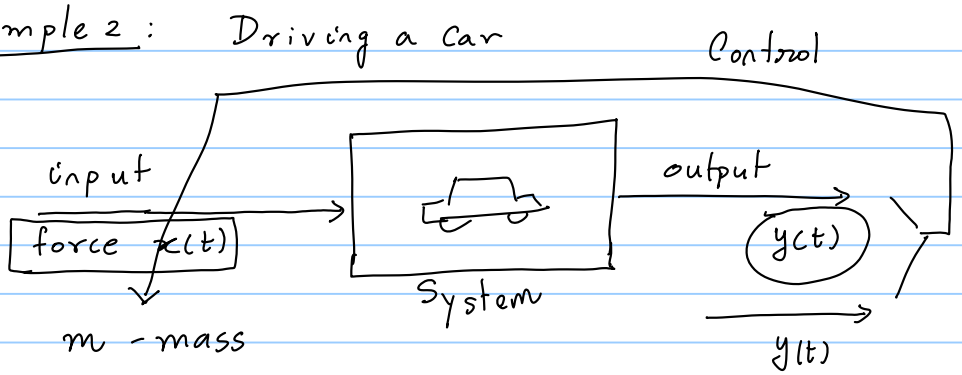








Example 2: Driving a Car



$c\,x(t)$ - force

$$\text{velocity}(t) = \frac{dy(t)}{dt} \qquad \text{acceleration} = \frac{d^2y(t)}{dt^2}$$

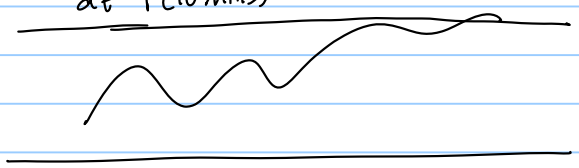
Force due to friction $\rho\, v(t) = \rho \frac{dy(t)}{dt}$

$$c\,x(t) - \rho \frac{dy(t)}{dt} = m \cdot \frac{d^2y(t)}{dt^2}$$

$$\boxed{m \frac{d^2y(t)}{dt^2} + \rho \frac{dy(t)}{dt} = c\,x(t)}$$ Differential Equation

We would like $y(10 \text{ mins}) = 5 \text{ miles}$

$$\left.\frac{dy}{dt}\right|_{(10 \text{ mins})} = 0$$



Discrete-time

Bank

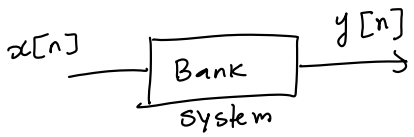
$x[n]$ ← amount of money deposited in the n^{th} month

$y[n]$ ← balance at the beginning of the month.

r ← interest (%) per month

1) $$y[n] = y[n-1]\left(1 + \frac{r}{100}\right) + x[n]$$

1	-500	$y[1] = x[1]$
2	-300	$y[2] = y[1]\left(1 + \frac{r}{100}\right) + x[1]$
3	-250	⋮



2) $$y[n] = x[1]\left(1+\frac{r}{100}\right)^{n-1} + x[2]\left(1+\frac{r}{100}\right)^{n-2} + \cdots + x[n-1]\left(1+\frac{r}{100}\right) + x[n]$$