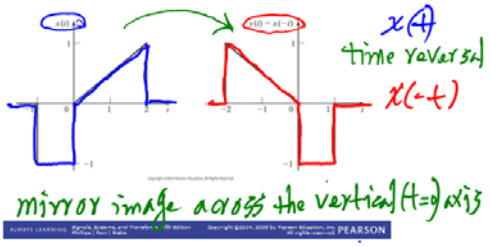
EE 103 Lect #2

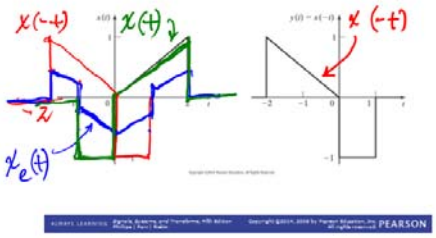
- HW of this week -
  1. Prob. 2-1 (i) & (iii) of the (5th ed) textbook
  2. Prob. 2-2 (i) & (iii)
  3. Prob. 2-9
  4. Prob. 2-15 (a) & (b)
  5. Prob 2-23 (a)
- Quiz on Monday April 10 is one of these except some changes of parameters. (15min)
- Midterm is on May 8 (instead of May 1).

A copy of the textbook will be available in the SJE Library later this week.



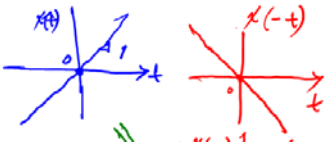
mirror image across the vertical (t=0) axis

Find $x_e(t) = \frac{1}{2}(x(t) + x(-t))$



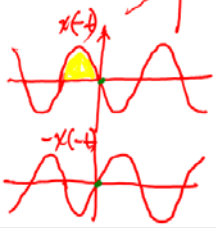
Odd symmetry

$x(t) = -x(-t)$



Another example

$x(t) = \sin 2\pi t$



Periodic & Aperiodic

$x(t)$ is a periodic signal with period T if $x(t) = x(t+T)$ for all t

otherwise $x(t)$ is aperiodic

$x_1(t) = \sin 2\pi t$ is periodic

$x_2(t) = \sin 2\pi t + \frac{2}{1+t^2}$ is aperiodic

$x_2(t+T) = \sin 2\pi(t+T) + \frac{2}{1+(t+T)^2} \neq x_2(t)$

Signal Power

ac = alternating current

A typical ac voltage signal is

$v(t) = V\sin(\omega t + \phi)$, $\omega = 2\pi f = 2\pi \times 60$

Power dissipated in R (like a filament)

$$p(t) = \frac{v^2}{R} = \frac{1}{R}[V\sin(\omega t + \phi)]^2$$

Average power

$$P = \frac{1}{T}\int_0^T p(t)\,dt$$

$$= \frac{V^2}{RT}\int_0^T \sin^2(\omega t + \phi)\,dt$$

$$= \frac{V^2}{RT}\int_0^T \left(\frac{1}{2} - \frac{1}{2}\cos 2(\omega t + \phi)\right)dt$$

$= \frac{V^2}{RT} \cdot \frac{1}{2} T = \frac{1}{2} \frac{V^2}{R}$

For 120[V] AC signal, say 100W light bulb

$P = \frac{1}{2} \frac{(120)^2}{R} = 100W$

thus $R = \frac{1}{2} \frac{14400}{100} = 72\,\Omega$

★ 100W Light bulb has 72Ω filament.

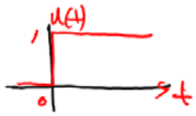
[v] is a voltage unit ≠ V peak magnitude.

TABLE 2.1 Transformations of Signals

Name	$y(t)$	
Time reversal	$x(-t)$	mirror image across $t=0$ axis
Time scaling	$x(at)$	
Time shifting	$x(t - t_0)$	shift t_0 to the right
Amplitude reversal	$-x(t)$	mirror image across t-axis
Amplitude scaling	$Ax(t)$	
Amplitude shifting	$x(t) + B$	(biasing)

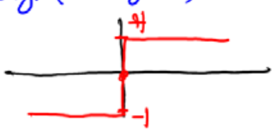
Elementary signals

Step function (also called unity function)



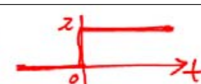
$u(t) = \begin{cases} 0 & t < 0 \\ 1 & t \geq 0 \end{cases}$

sign (or signum) function



$sgn(t) = \begin{cases} -1 & t < 0 \\ 0 & t = 0 \\ +1 & t > 0 \end{cases}$

$sgn(t) + 1 =$



thus $u(t) = \frac{1}{2}(sgn(t) + 1)$

Ramp function $R(t)$

$R(t) = \begin{cases} 0, & t < 0 \\ t, & \geq 0 \end{cases}$

$R(t) = t\,u(t)$

Asilomar Conference site, Pacific Grove

The Asilomar Conference on Signals, Systems, and Computers is a yearly Conference held on the Asilomar Grounds in Pacific Grove, CA, USA.

The IEEE Signal Processing Society is a technical co-sponsor. It provides a forum for presenting recent and novel work in various areas of theoretical and applied signal processing.

General areas of interest to the forum include:

- ✓ Architecture and Implementation
- ✓ Array Signal Processing
- ✓ Biomedical Signal & Image Processing
- ✓ Communication Systems
- ✓ MIMO Communications & Signal Processing
- Networks
- ✓ Signal Processing & Adaptive Systems
- ✓ Speech, Image & Video Processing