Statistical Parameters

Quantity	Continuous	Discrete
Mean	$\bar{x} = \frac{1}{T}\int_0^T x(t)dt$	$\bar{x} = \frac{1}{N}\sum_{i=1}^N x_i$
Variance	$S_x^2 = \frac{1}{T}\int_0^T [x(t) - \bar{x}]^2 dt$	$S_x^2 = \frac{1}{N-1}\sum_{i=1}^N [x_i - \bar{x}]^2$
Standard Deviation	$S_x = \sqrt{\frac{1}{T}\int_0^T [x(t) - \bar{x}]^2 dt}$	$S_x = \sqrt{\frac{1}{N-1}\sum_{i=1}^N [x_i - \bar{x}]^2}$
rms	$x_{rms} = \sqrt{\frac{1}{T}\int_0^T x(t)^2 dt}$	$x_{rms} = \sqrt{\frac{1}{N}\sum_{i=1}^N x_i^2}$

Table 11.1

In-Class Example

Determine the mean and variance of x(t) = 3sin(4πt) for one period and 1.5 periods.

What is the period of 3sin(4πt) ?

Mean: $$\bar{x} = \frac{1}{T}\int_0^T x(t)dt$$

for one period:

In-Class Example

for 1.5 periods:

Variance: $S_x^2 = \frac{1}{T}\int_0^T \left[x(t) - \bar{x}\right]^2 dt$

for one period:

for 1.5 periods:

The Root-Mean-Square (rms)

- For a continuous waveform:

$$x_{rms} \equiv \sqrt{\frac{1}{t_2 - t_1}\int_{t_1}^{t_2} x^2(t)dt}$$

- For a discrete waveform:

$$x_{rms} \equiv \sqrt{\frac{1}{N}\sum_{i=1}^{N} x_i^2}$$

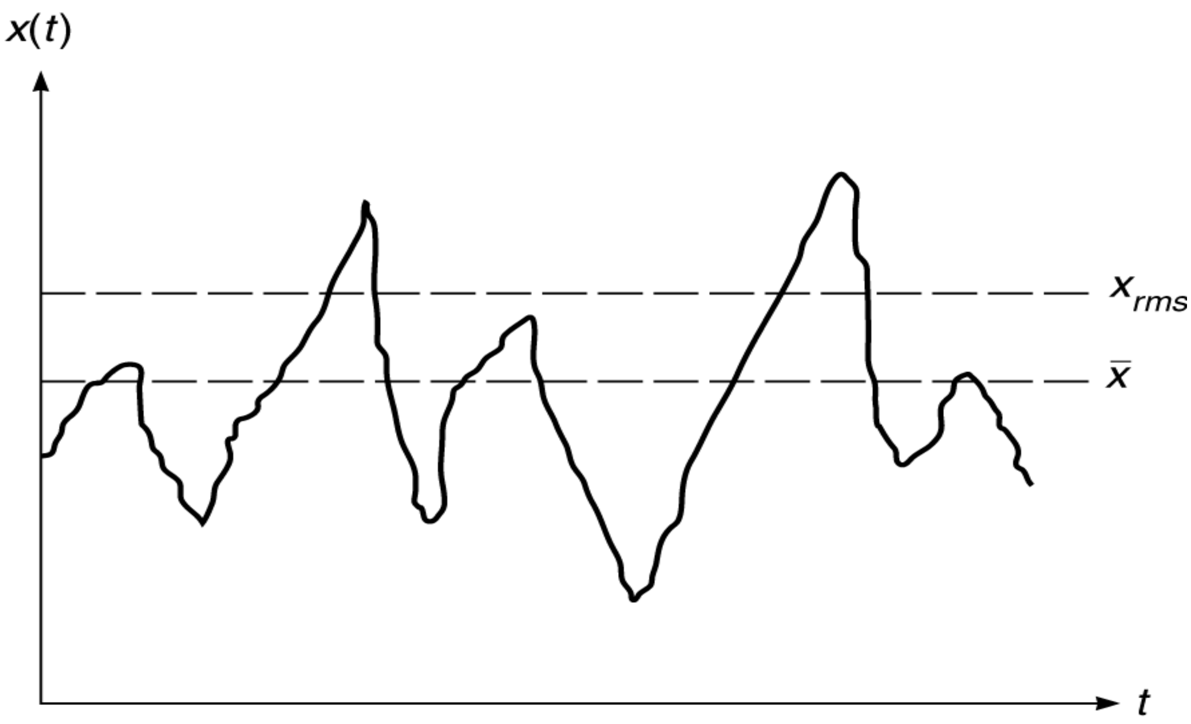
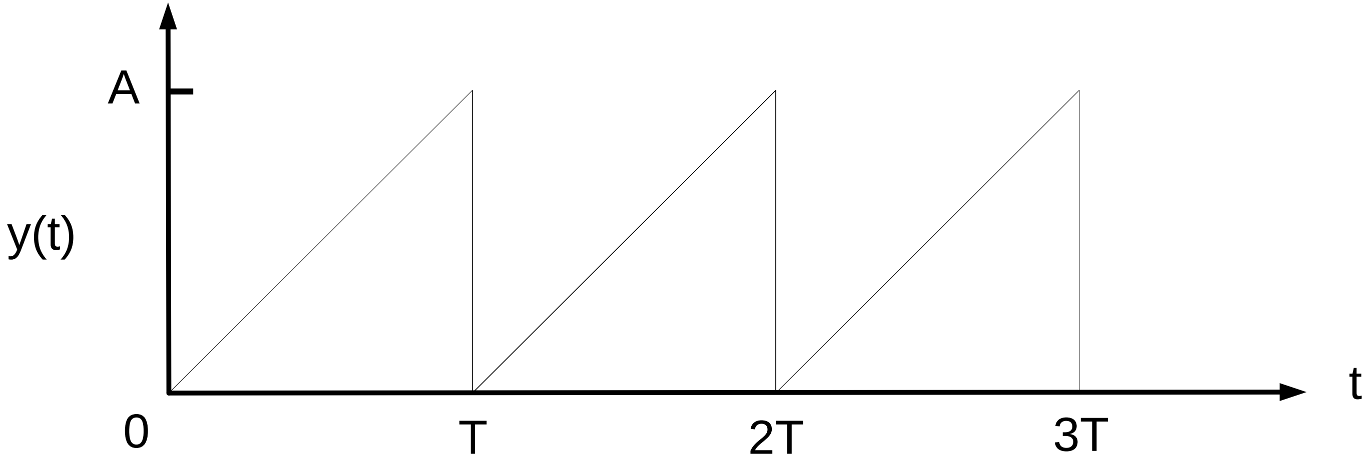


Figure 11.8

In-Class Example

- Determine the rms for 3 cycles of the ramp function y(t) = At/T.



- What kind of signal is this?

- How many periods must be considered for this waveform?

In-Class Example

$$y_{rms} = \sqrt{\frac{1}{t_2 - t_1}\int_{t_1}^{t_2} y^2(t)dt}$$

- What is the mean value of y(t)?

In-Class Example

Determine the rms of $x(t) = 3\sin(4\pi t)$ for one period.