Signal Energy

1. Signal Energy

– Signal energy is area under the squared signal [1]:

$$E_y = \int_{-\infty}^{\infty} y^2(t)dt \tag{1.1}$$

– An example is shown on following figure:

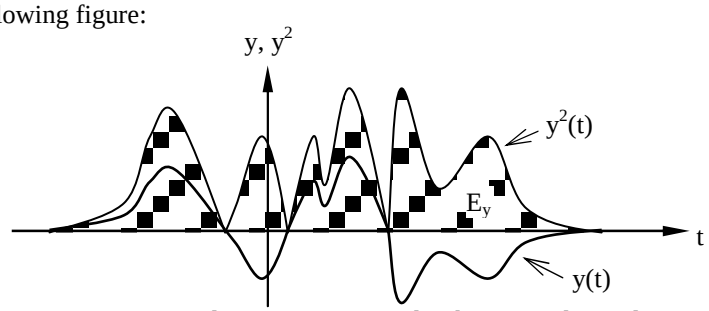

Figure 1.1. Signal energy is area under the squared signal.

– Energy of infinite signal is also infinite like for instance energy of infinite periodic signal as shown on following picture:

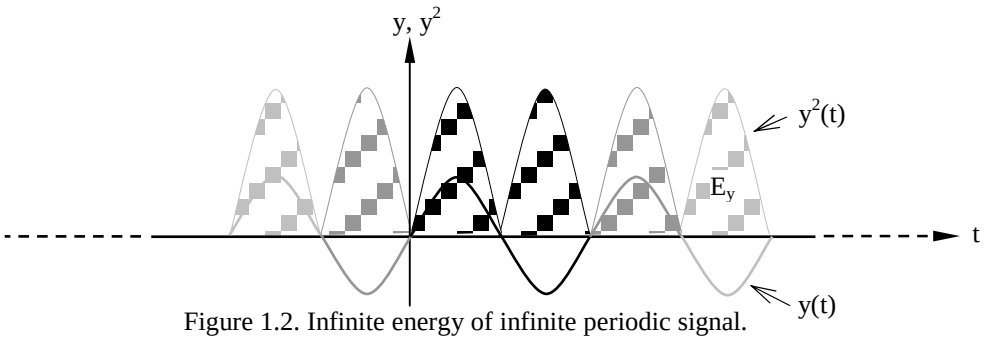

Figure 1.2. Infinite energy of infinite periodic signal.

– For such signals energy has no useful value because it has the same infinite value for all of them.

2. Signal Power

– Power is defined as energy per time:

$$P_{y[t_1,t_2]} = \frac{E_{y[t_1,t_2]}}{t_2 - t_1} \tag{2.1}$$

where: $P_{y[t1,t2]}$ – signal power during period $[t_1,t_2]$
$E_{y[t1,t2]}$ – signal energy during period $[t_1,t_2]$

2.1. Signal Power of non-infinite signal

– For non-infinite signal, total signal energy is calculated like this:

$$E_y = \int_{t_1}^{t_2} y^2(t)dt \tag{2.2}$$

– Power is then calculated as defined with ???? which is ilustrated in following picture:

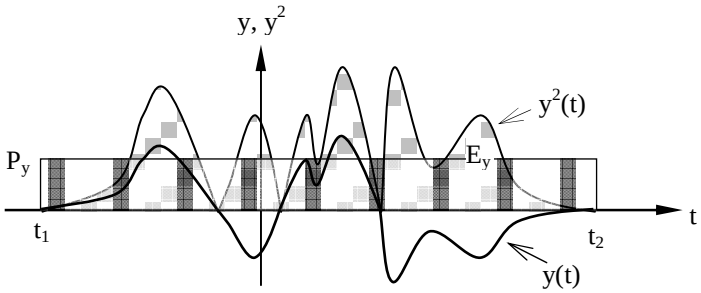

Figure 2.1. Power of non-infinte signal.

2.2. Signal Power of infinite periodic signal

– For infinite periodic signal, signal energy of one period is calculated like this:

$$E_{y[0,T]} = \int_{0}^{T} y^2(t)dt \tag{2.3}$$

– Power of such signal is equal to the power of single period, which can be calculated like this:

$$P_y = \frac{E_{y[0,T]}}{T} \tag{2.4}$$

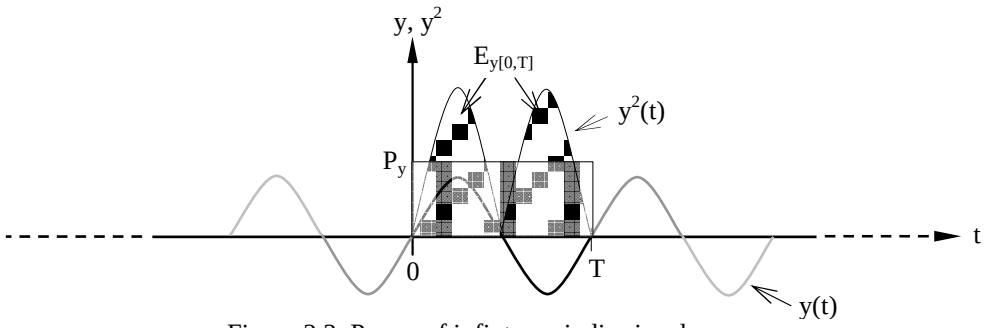

Figure 2.2. Power of infinte periodic signal.

2.3. References

[1] http://cnx.org/content/m10055/latest/