ISS – Numerical exercises I.

Valentina Hubeika, Jan Černocký, FIT BUT Brno

Exercise 1

Given a signal with continuous time:

$$s(t) = \begin{cases} t+1 & \text{for} \quad -1 \leq t \leq 1 \\ 0 & \text{otherwise} \end{cases}$$

a) draw signal $s(t)$.
b) draw signals $s(t-2)$, $s(t+2)$, $s(-t-2)$, $s(-t+2)$, $s(3t)$, $s(t/3)$.
c) draw instantaneous power $p(t)$ graph.
d) calculate the signal's energy in the interval $t \in [-1, 1]$.
e) calculate the signal's overall energy E_∞ and the mean power P_∞.
f) answer: has the signal finite energy ?

Exercise 2

Given a descrete signal:

$$s[n] = \begin{cases} 3 & \text{for} \quad n = 0 \\ 2 & \text{for} \quad n = 1 \\ 1 & \text{for} \quad n = 2 \\ 0 & \text{otherwise} \end{cases}$$

a) draw signal $s[n]$.
b) draw signals $s[n-3]$, $s[n+3]$, $s[-n-3]$, $s[-n+3]$.
c) draw instantaneous power $p[n]$ graph.
d) calculate the signal's overall enerdy E_∞ and overall mean power P_∞.

Exercise 3

Given a periodic signal:

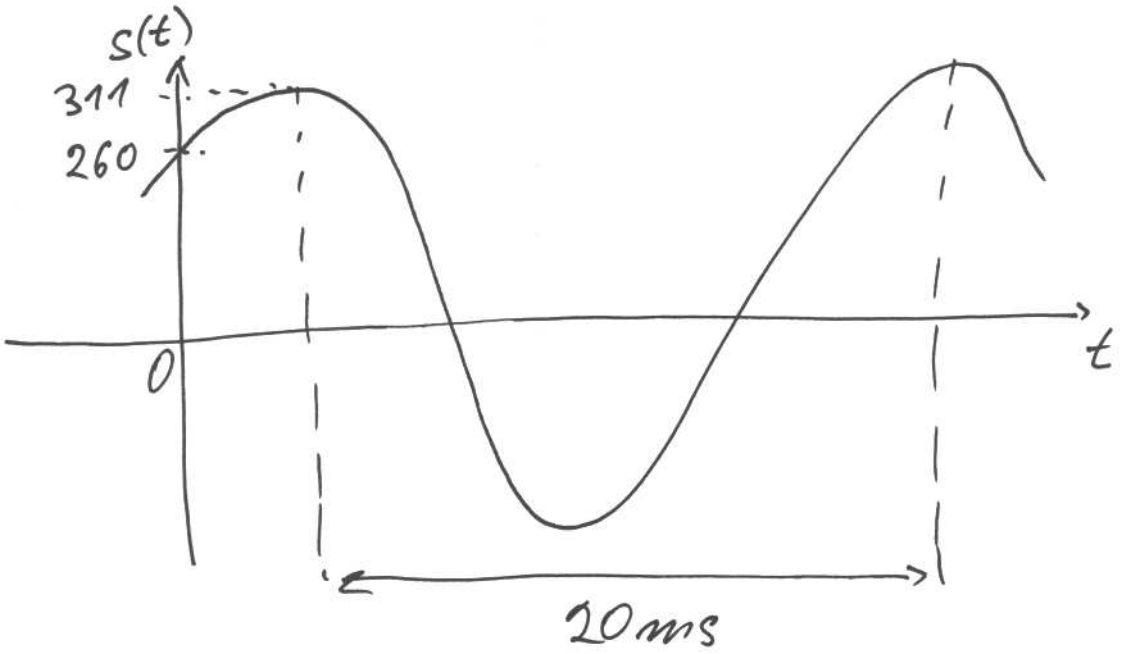
$$s(t) = \begin{cases} 4 & \text{for} \quad 0 < t \leq 1 \\ -1 & \text{for} \quad 1 < t \leq 3 \end{cases}$$

with the fundamental period $T_1 = 3$.

a) draw signal $s(t)$.
b) draw signal $s(t-1)$.
c) calculate mean value of the signal.
d) draw instantaneous power $p(t)$ graph.
e) calculate mean power P_s.
f) calculate the signal's effective value C_{ef}.
g) calculate the signal's overall energy E_∞.

Exercise 4

In the picture, there is a harmonic signal with continuous time $s(t) = C_1 \cos(\omega_1 t + \phi_1)$:



a) calculate C_1, ω_1 and ϕ_1 and express the signal by the equation $s(t) = C_1 \cos(\omega_1 t + \phi_1)$.
b) an alternative form is $s(t) = C_1 \cos[\omega_1(t + \tau_1)]$, where τ_1 is the initial shift. Calculate τ_1.

Exercise 5

draw signal $s(t) = 5\cos(4\pi t + 1)$.

Exercise 6

Harmonic signals with descrete time have general definition:

$$s[n] = C_1 \cos(\omega_1 n + \phi_1)$$

. Given a signal with descrete time: $s[n] = 5\cos(\frac{\pi}{6}n)$.

a) find initial period N_1.
b) draw signal $s[n]$. You can use an auxiliary function $\cos(\frac{\pi}{6}t)$.

Exercise 7

Given a harmonic signal with discrete time: $s[n] = \cos(\frac{3\pi}{16}n)$.

a) find initial period N_1.
b) draw signal $s[n]$. You can use an auxiliary function $\cos(\frac{3\pi}{16}t)$.