

Serie Nº. 1 (Signals)

Exercice 01 :

A sonar is a device that uses water sound propagation to detect and locate objects underwater. Consider the following setup: A group of fish emits sounds underwater near two boats; the first is a maritime navigation boat using a sonar 1 to measure depth. The second is a fishing boat using a second sonar to catch fish.

Determine each of the systems (the navigation boat, the fishing boat, and the fish): The system comprises the useful signal(s), the noise(s), the transmitter(s), the receiver(s), and the transmission channel(s).



Exercice 02:

1) Provide an expression for the signal x(t).

2) Give a value such that the area under x(t) equals one.

3) For $b \neq 0$, plot x(b.t) and compare it with the signal x(t) in the following two cases: |b|>1 and |b|<1



Exercice 3:

Demonstrate that the sawtooth signal (Figure opposite) is both a finite-power signal and an infinite-energy signal.



Exercice 4: (additional)

Calculate the energy for the following signals:

- $x(t) = \exp(-\alpha t) \cdot u(t)$; avec $\alpha > 0$
- $x(t) = t \cdot \exp(-\alpha t) \cdot u(t)$; avec $\alpha > 0$

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$$x(t) = \exp\left(-\frac{t^2}{2\alpha^2}\right)$$
; avec $\alpha \neq 0$

Calculate the power of the following signals:

$$-x(t) = x_0 \exp(j\omega_0 t)$$

 $- x(t) = x_0 \cos(j\omega_0 t)$

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