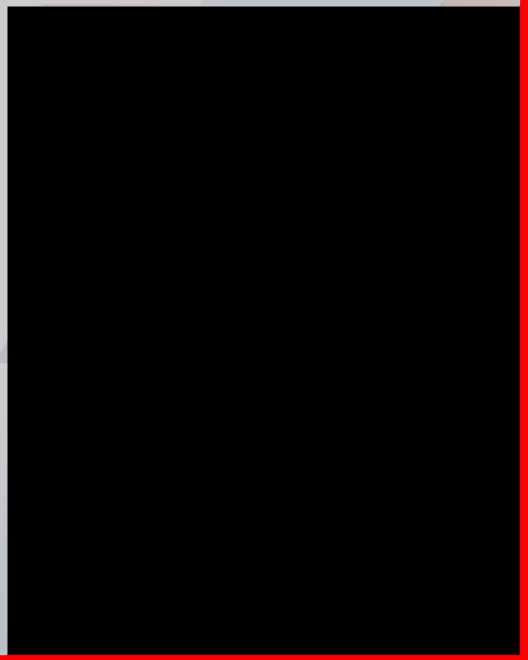
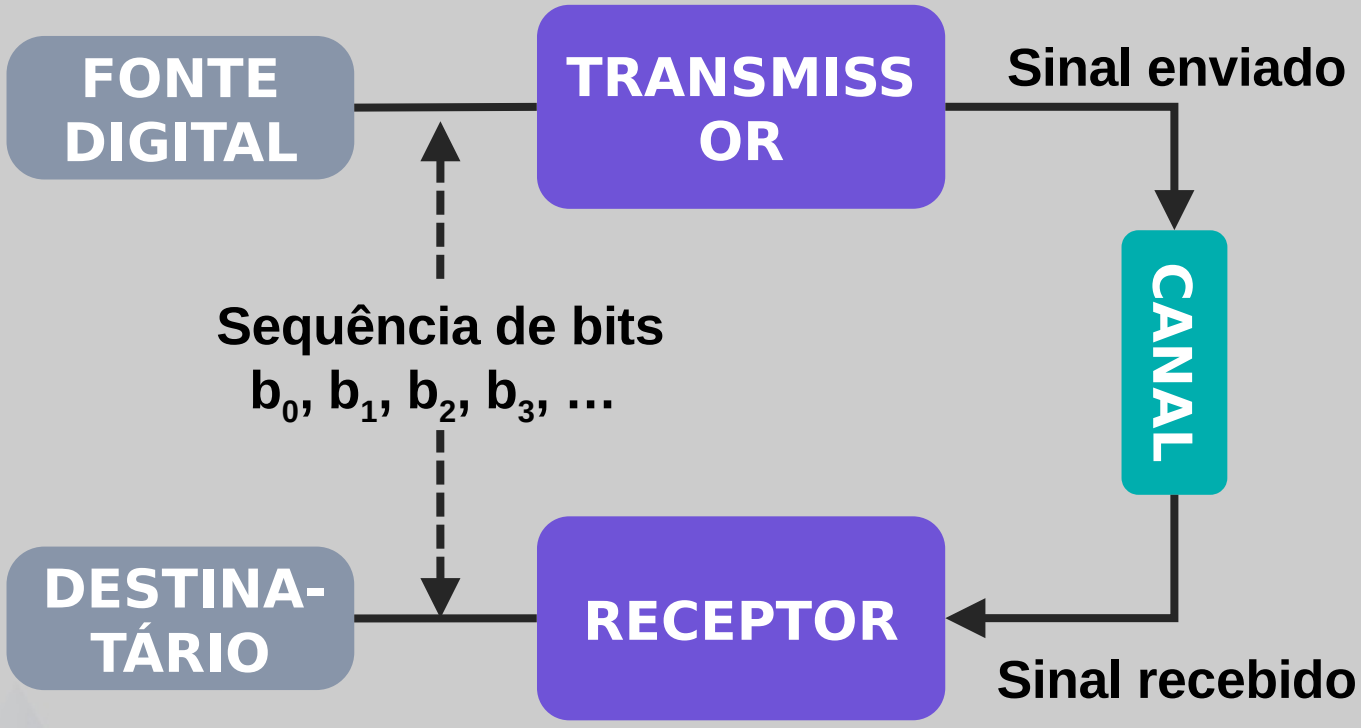
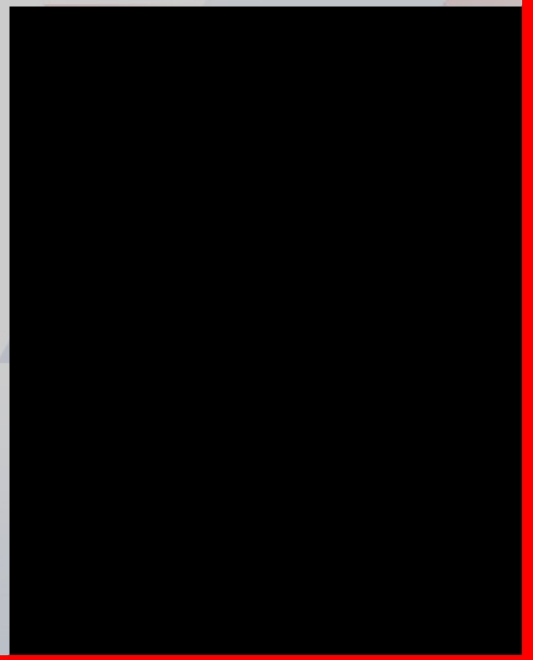
INTRODUÇÃO AOS SISTEMAS DE COMUNICAÇÃO

A Resposta em Frequência do Canal



MODELO DE SISTEMAS DE COMUNICAÇÃO DIGITAL





FREQUÊNCIA

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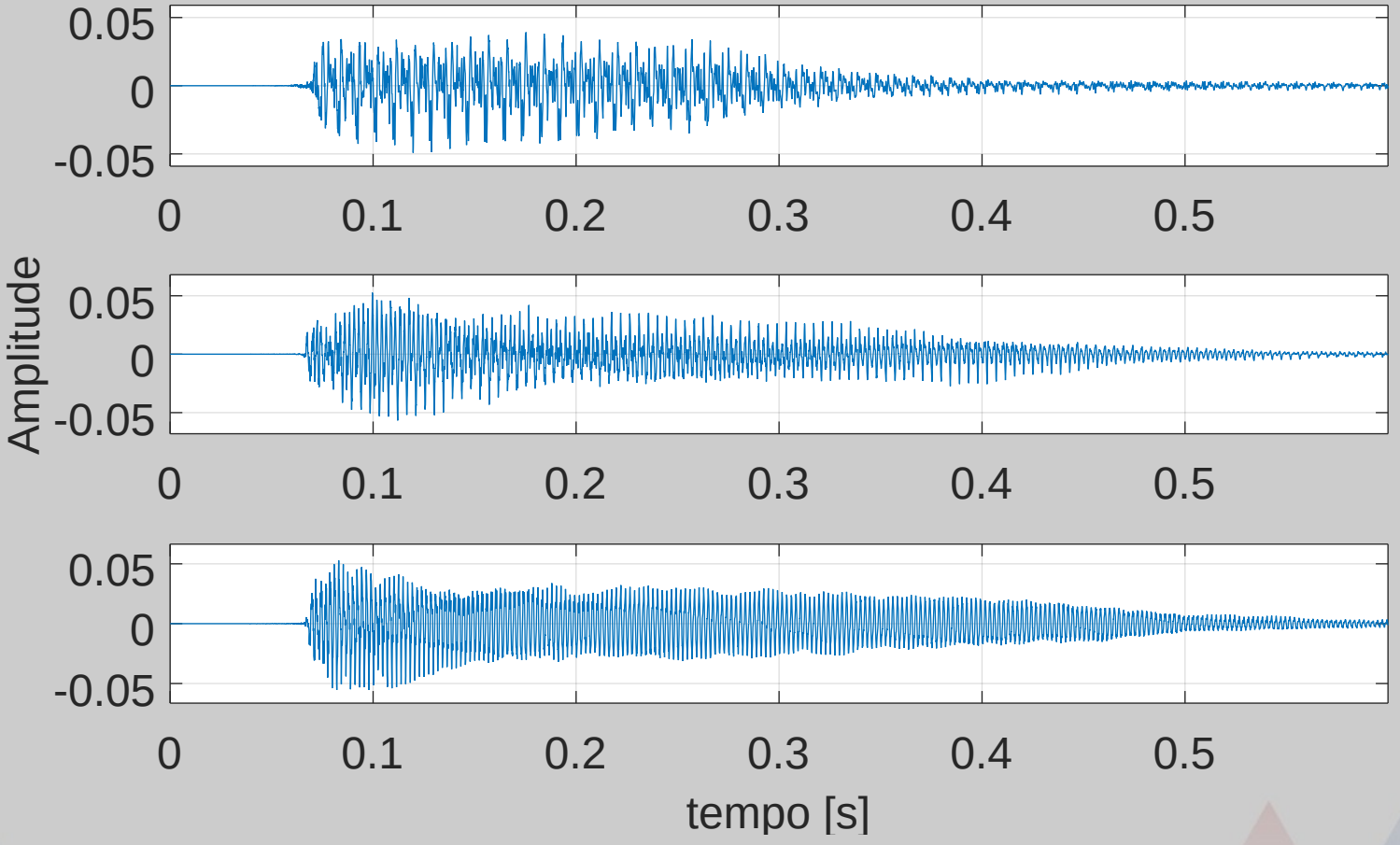
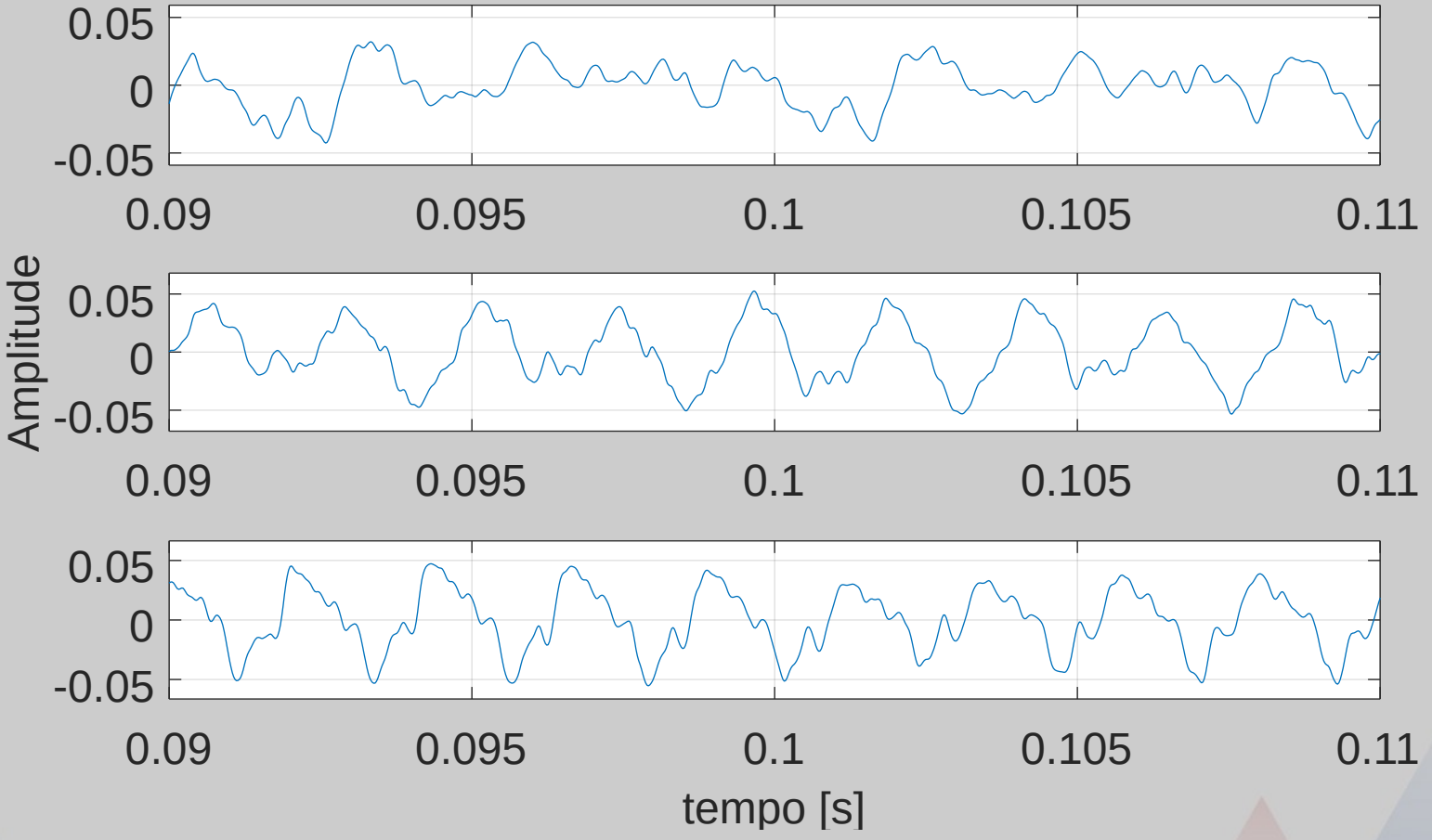
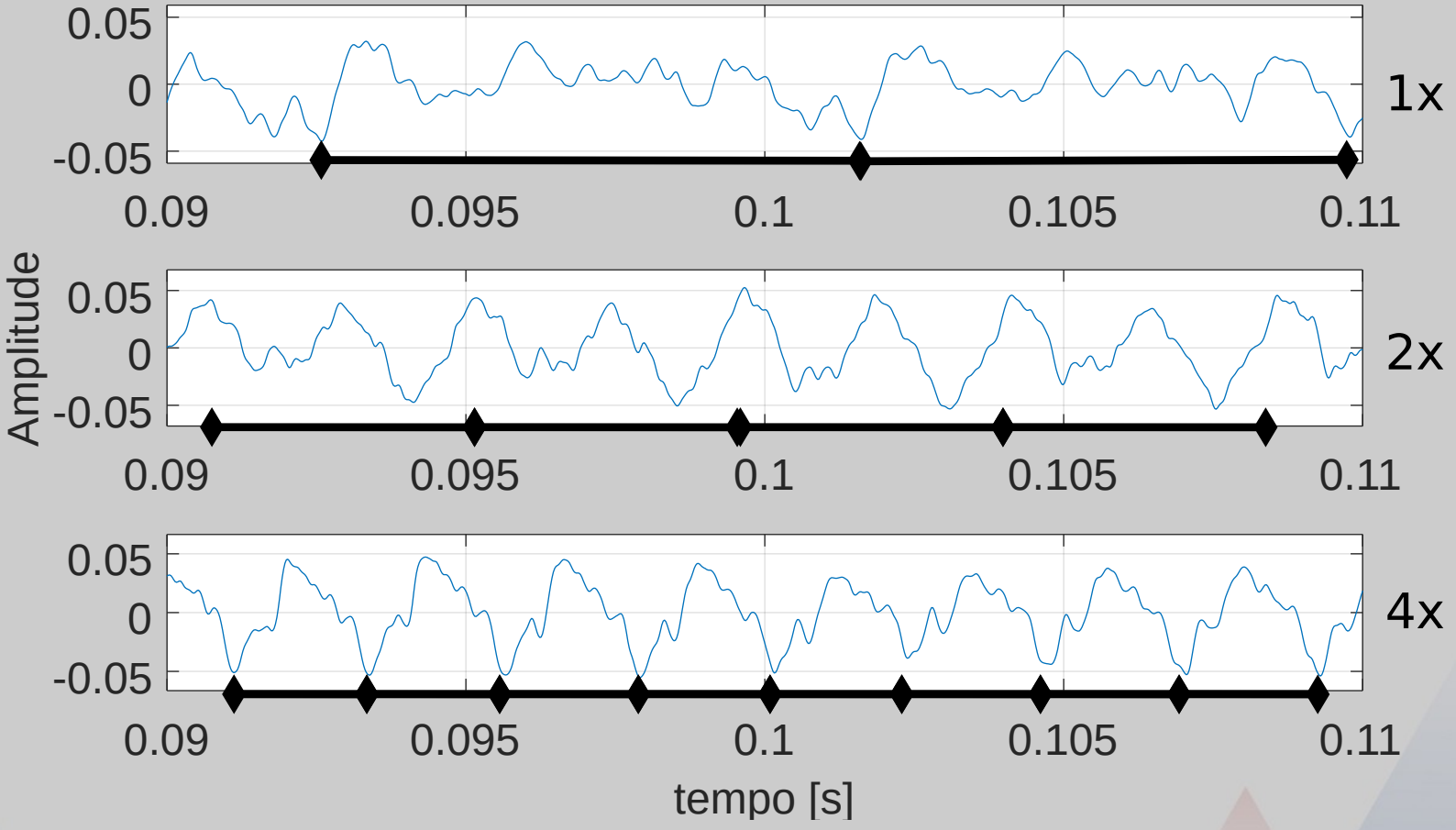


FREQUÊNCIA



FREQUÊNCIA

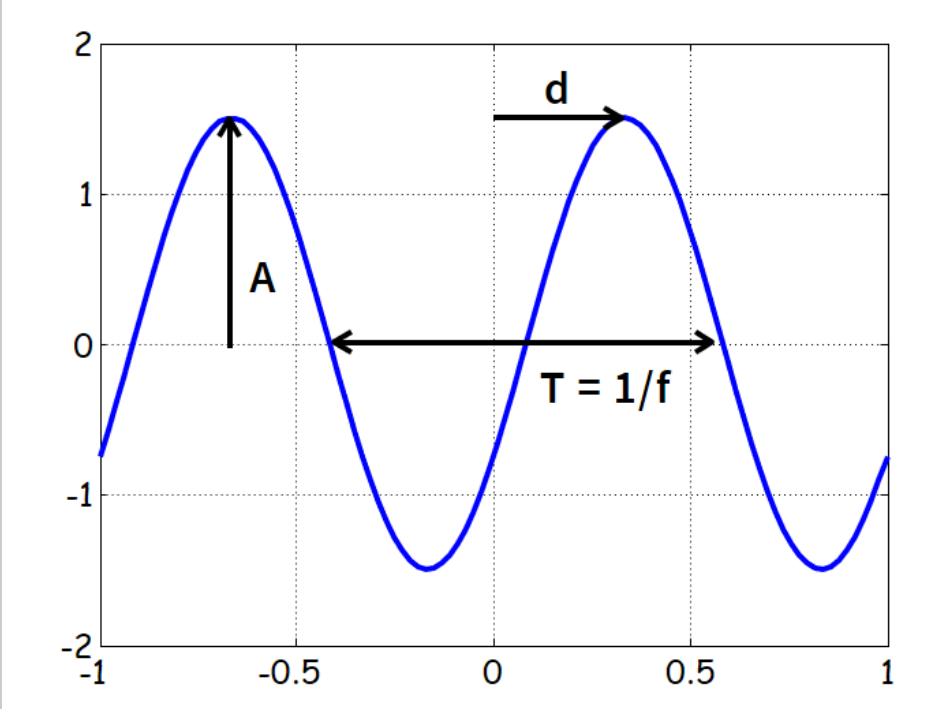


SENOIDES

$$x(t) = A\cos(2\pi f \cdot t + \Phi)$$

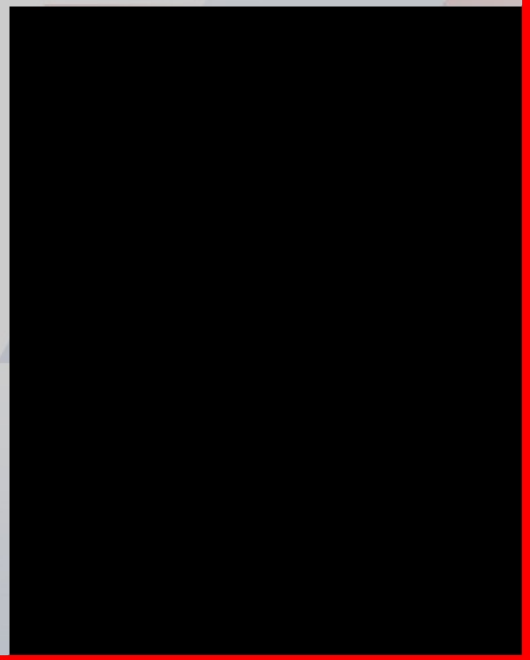
- A = amplitude
- T = período
- f = frequência
- = fase

- d = atraso $-\frac{\Phi}{2\pi f}$



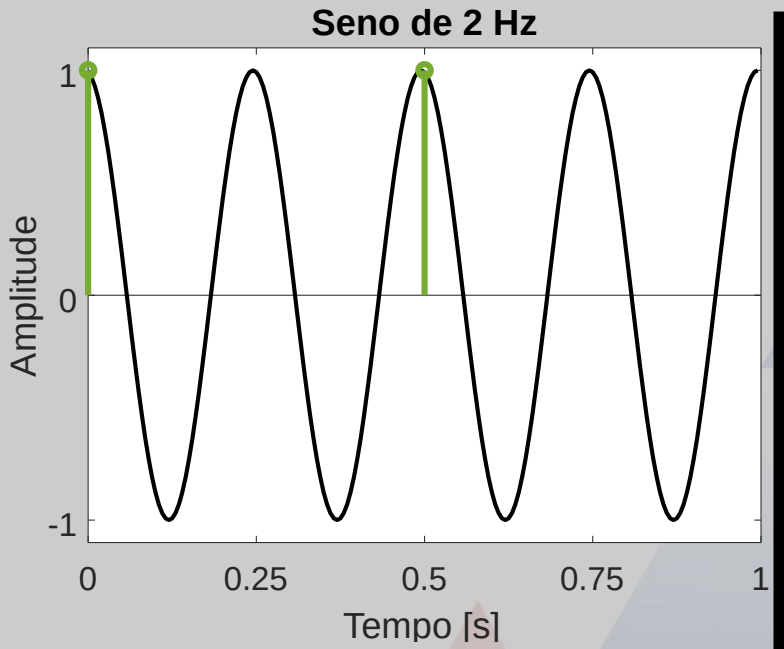
SENOIDES DISCRETAS

- f_s = Frequência de amostragem
- $t = n/f_s$, $n = 0, 1, 2, \ldots$
- $f_k = f/f_s$ = Frequência normalizada



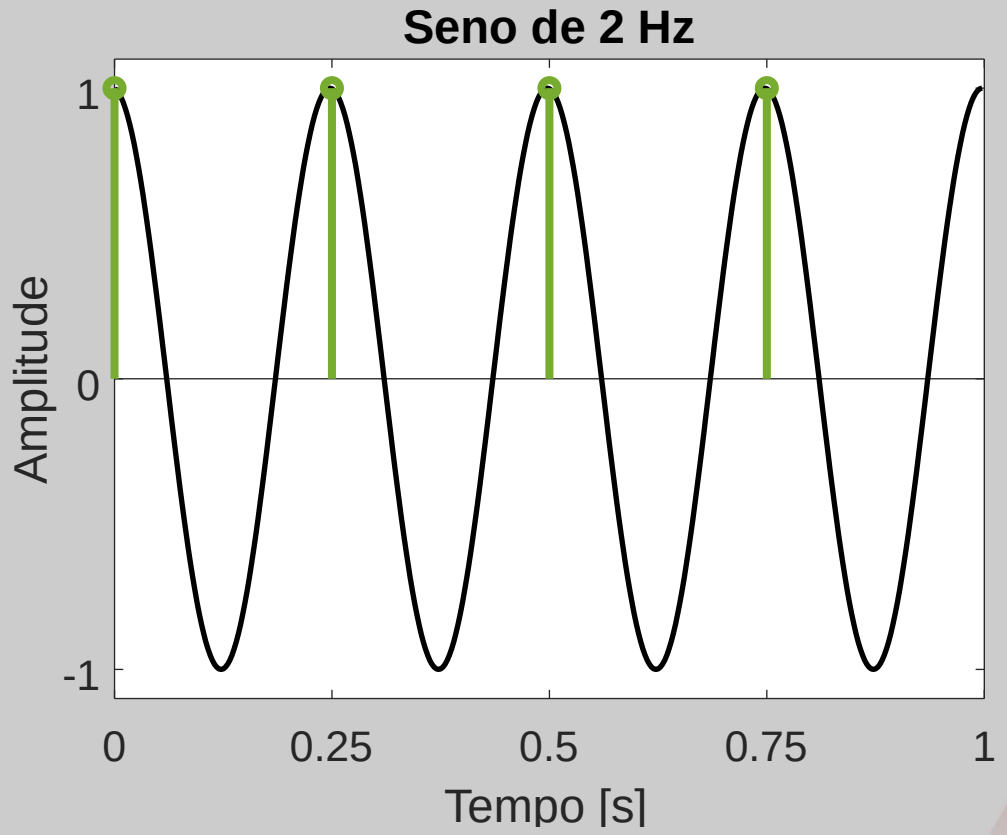
FREQUÊNCIA NORMALIZADA

- **Não tem sentido ter mais ciclos que amostra!**



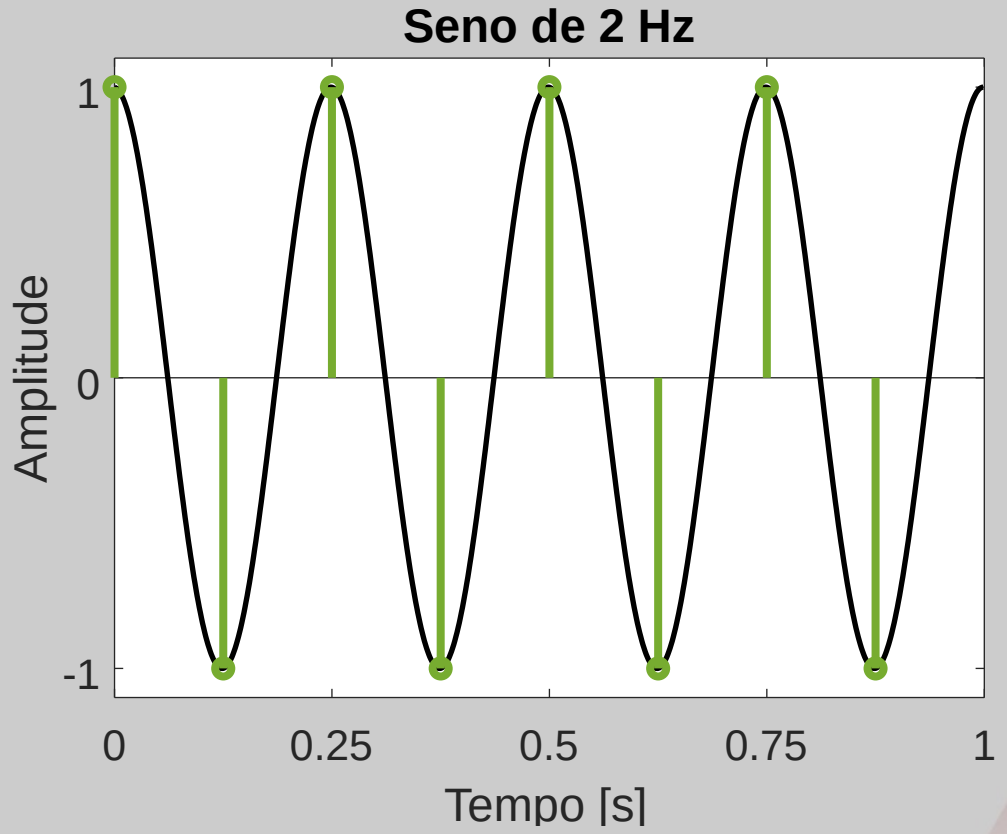
SENOIDES DISCRETAS

- $f_k = 1$



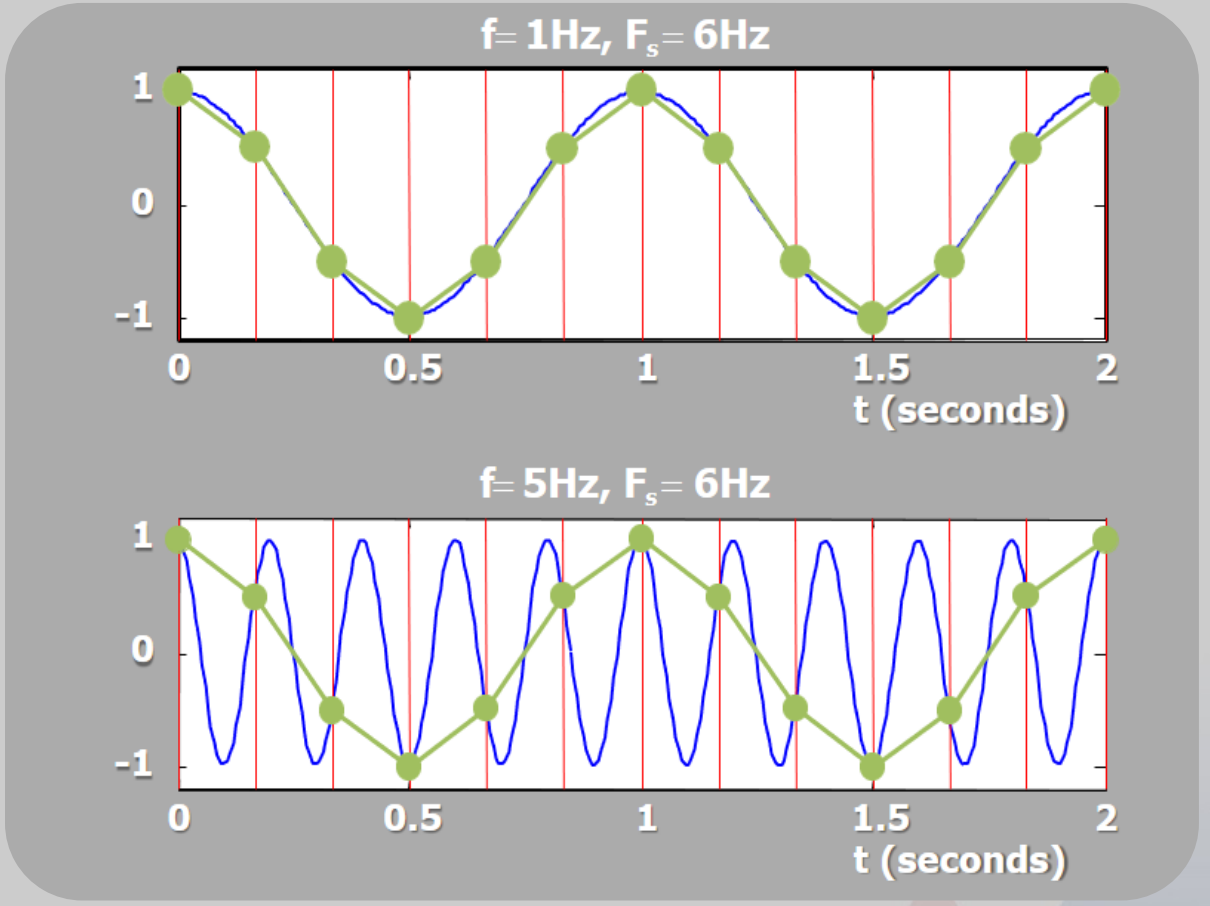
SENOIDES DISCRETAS

- $f_k = 0,5$

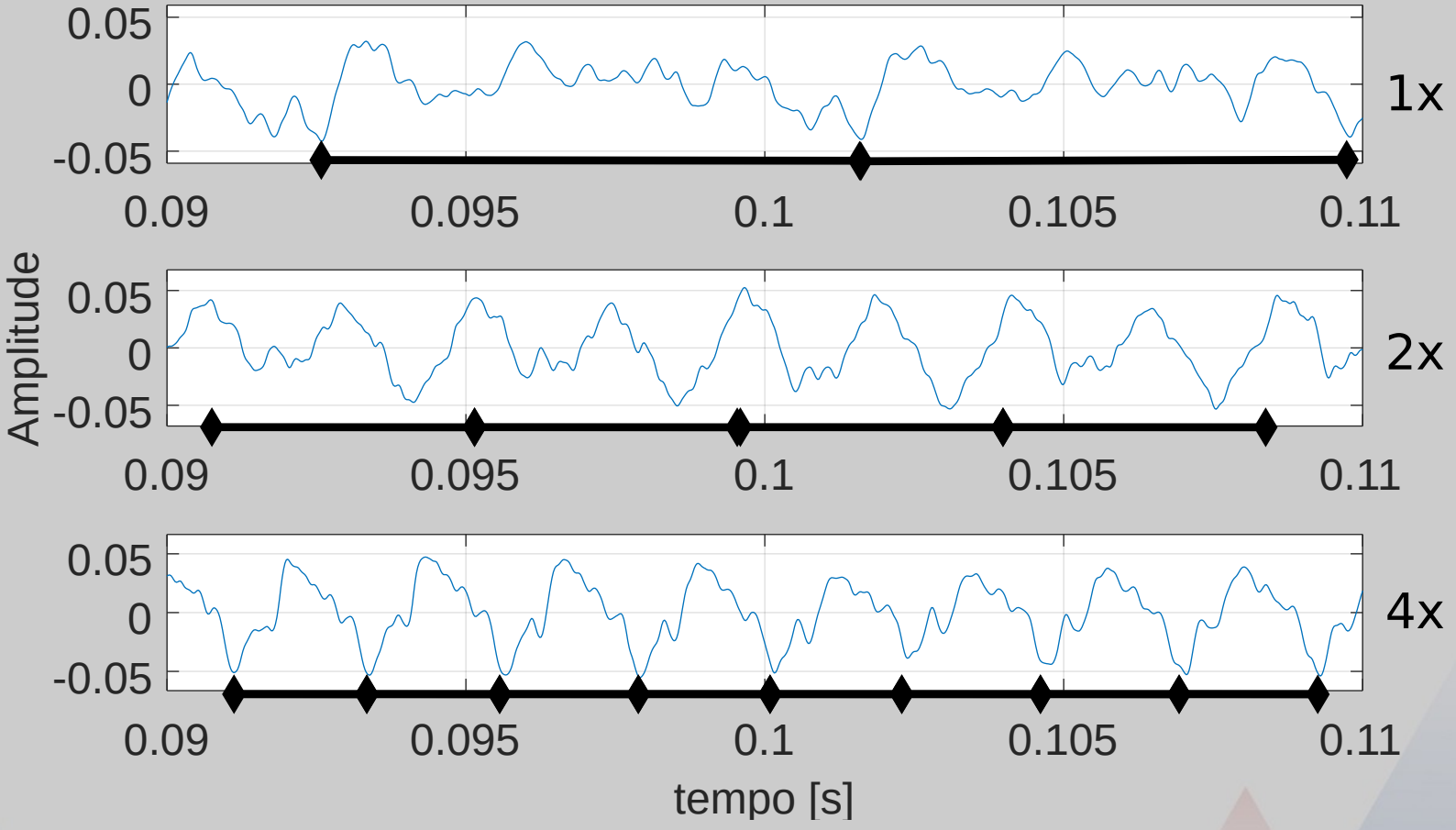


LIMITE DE NYQUIST

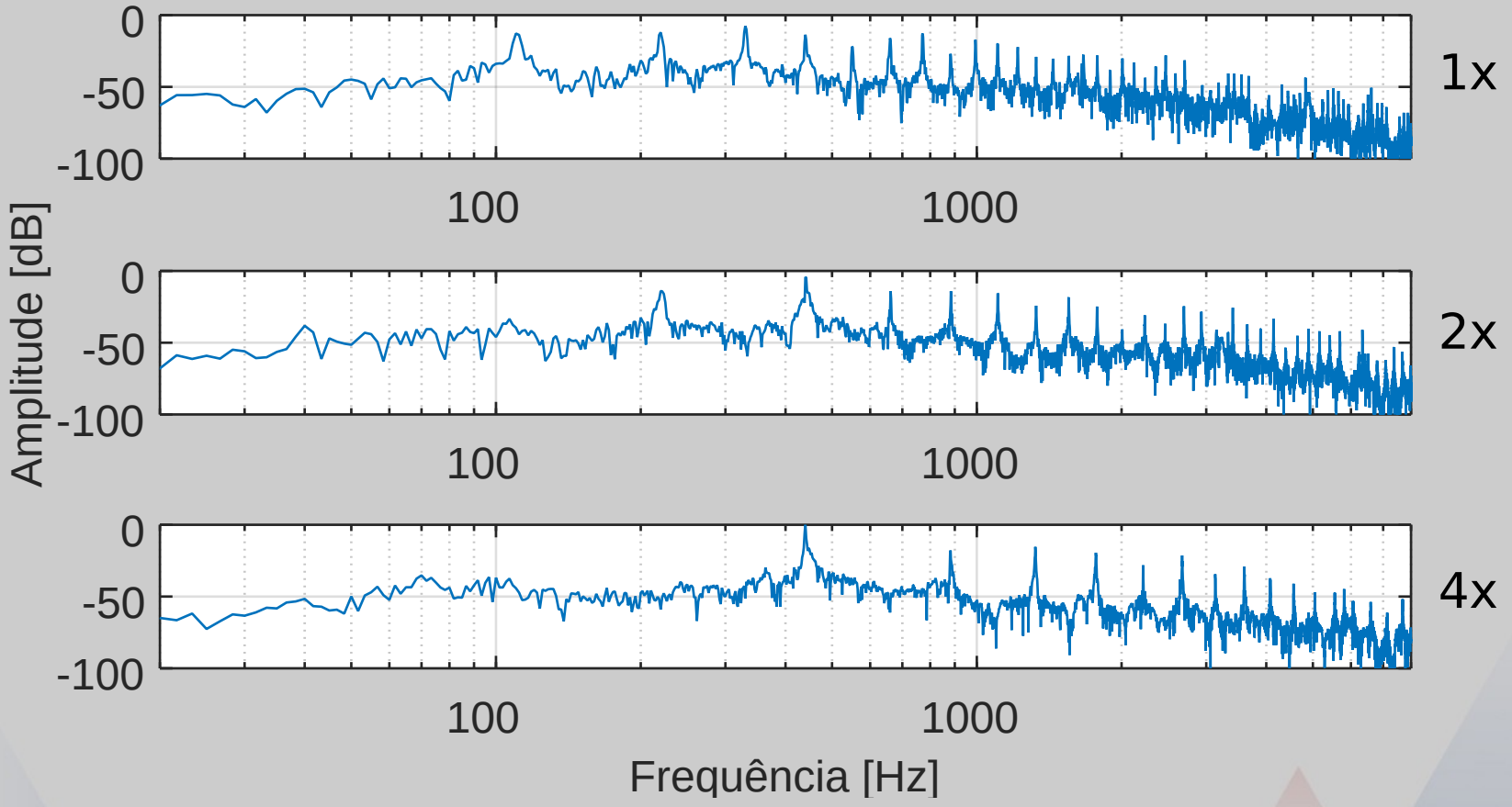
- $f < f_s/2$



FREQUÊNCIA

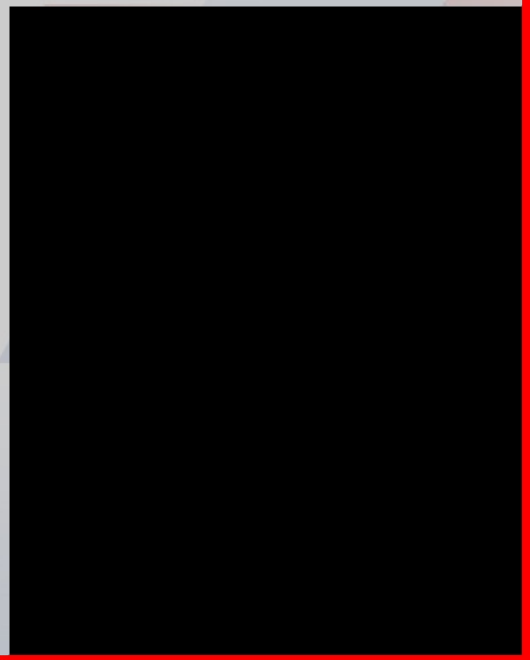


ESPECTRO DE FREQUÊNCIA

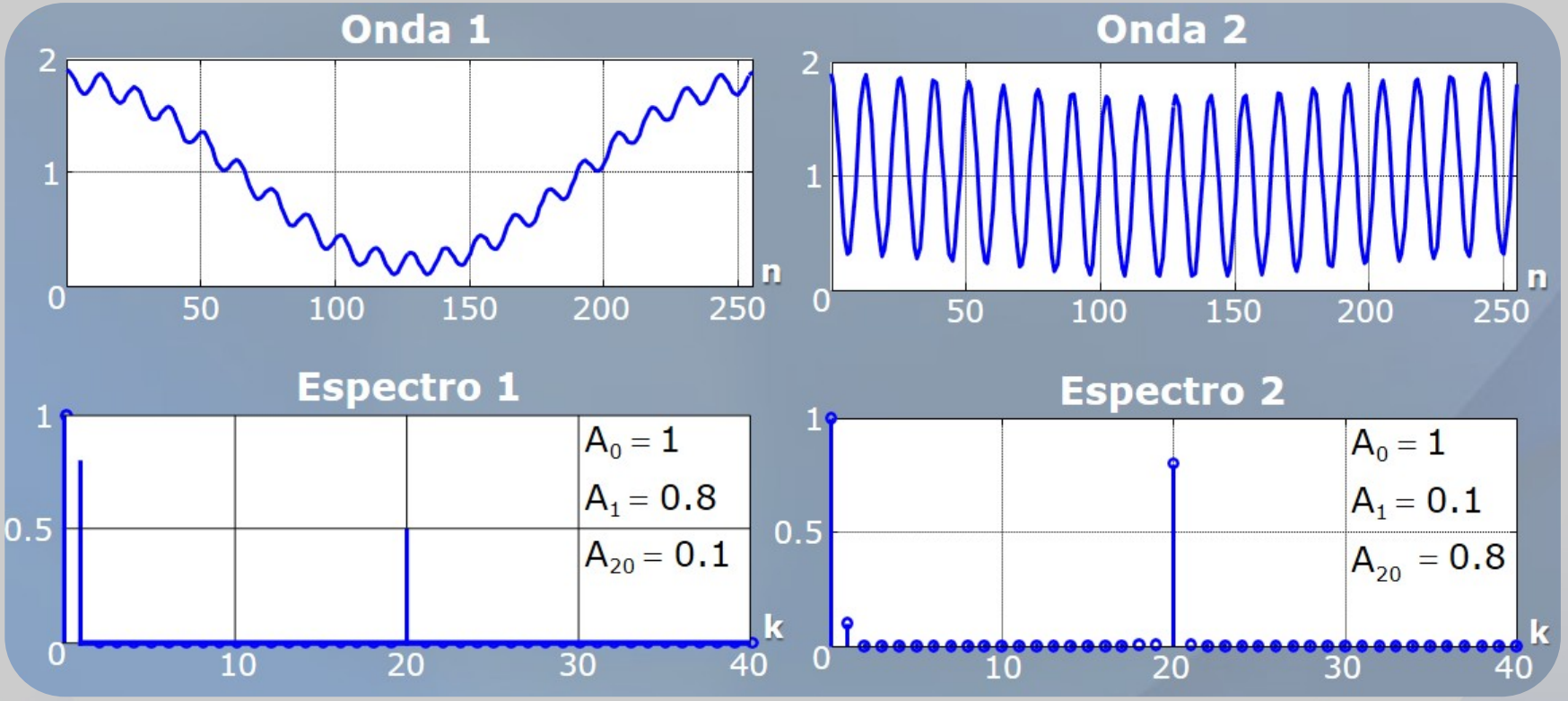


SÉRIE DE FOURIER

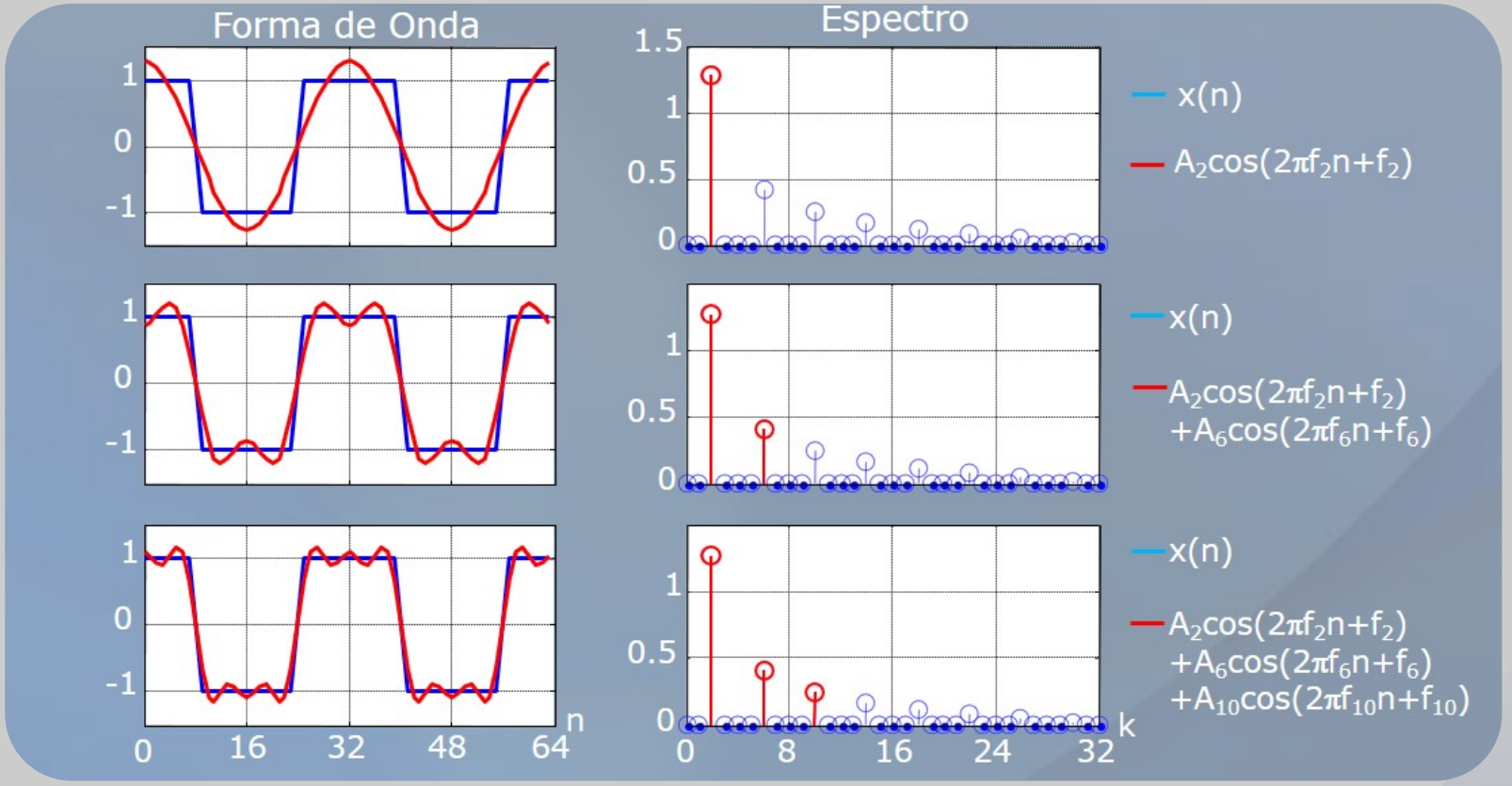
- A_k = amplitude de cada senoide
- f_k = frequência de cada senoide



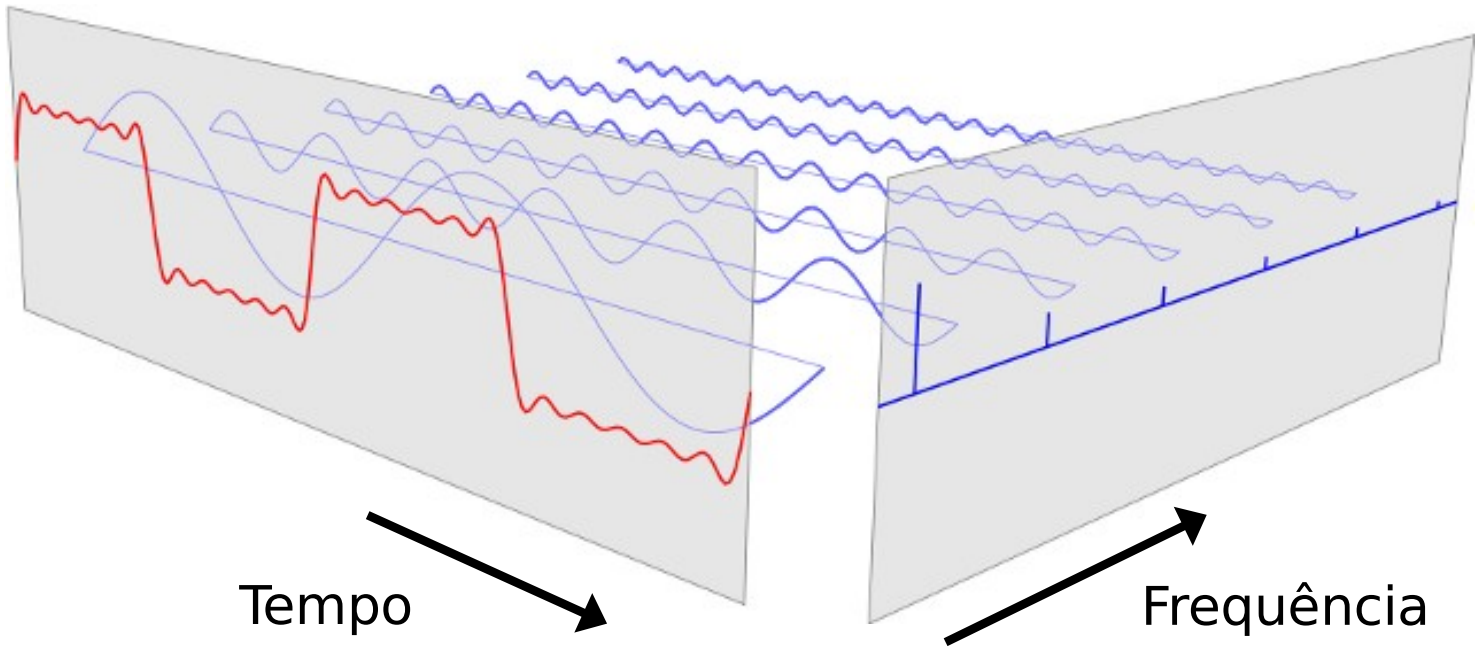
EXEMPLO


Onda 1
2
1
0
50
100
150
200
250
n
Onda 2
2
1
0
50
100
150
200
250
n
Espectro 1
1
0.5
0
10
20
30
40
k
$A_0 = 1$
$A_1 = 0.8$
$A_{20} = 0.1$
Espectro 2
1
0.5
0
10
20
30
40
k
$A_0 = 1$
$A_1 = 0.1$
$A_{20} = 0.8$

EXEMPLO: ONDA QUADRADA

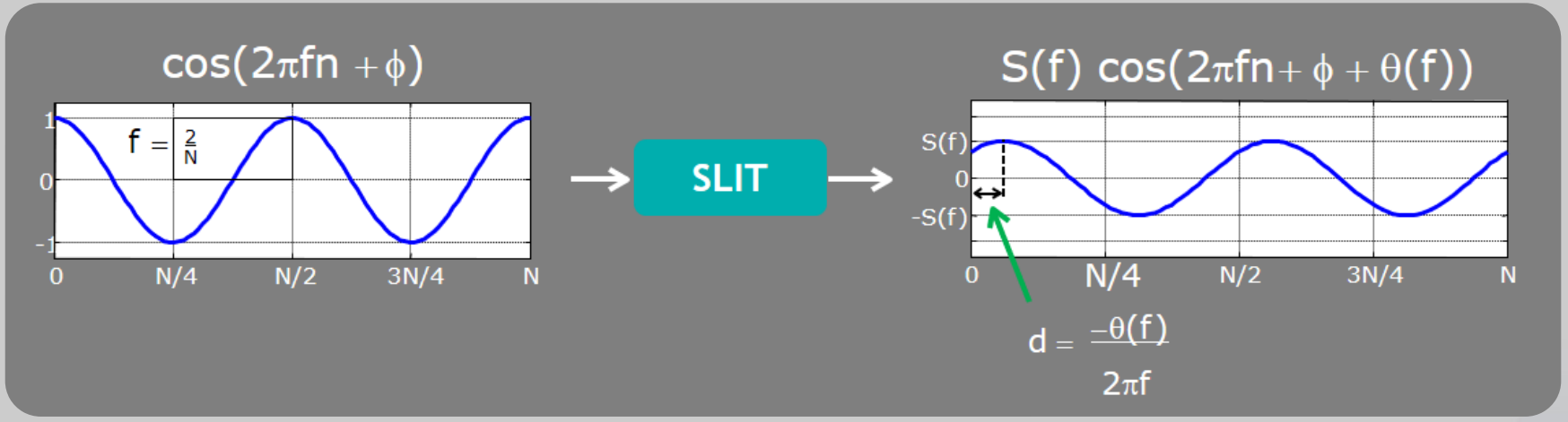


TRANSFORMADA



RESPOSTA EM FREQUÊNCIA

- **Resposta de um SLIT a uma senoide**

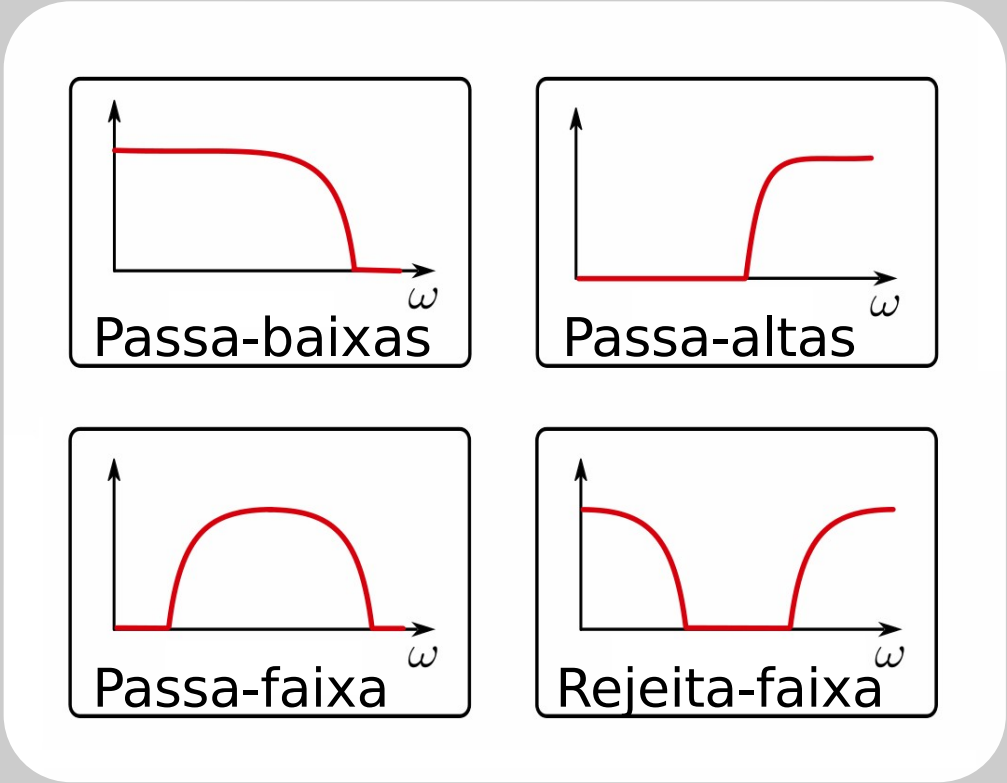


FILTROS

- **Um filtro é algo que permite que apenas certas partes da entrada passem para a saída.**

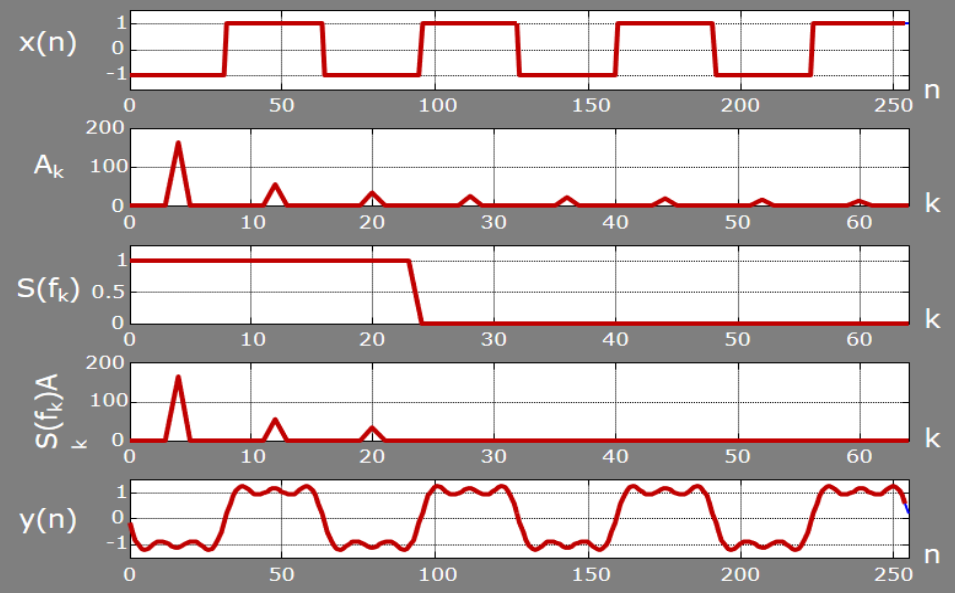
FILTROS

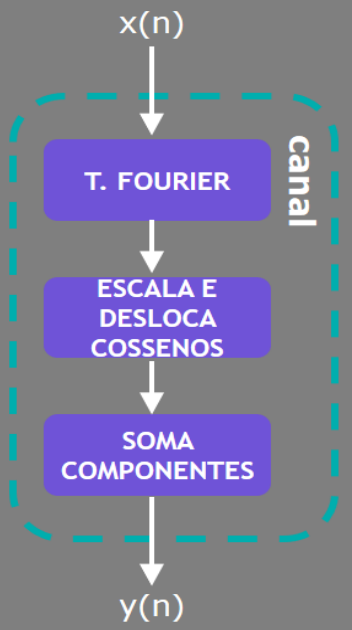
- **Resposta em frequência**



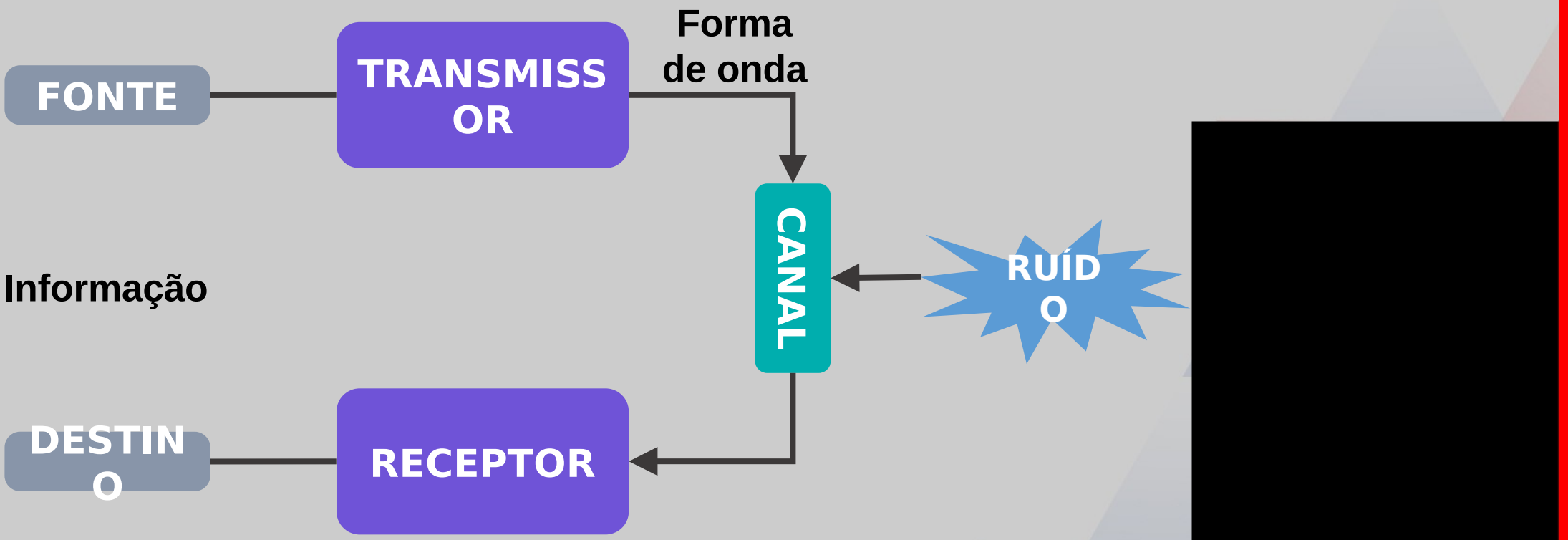
EXEMPLO: FILTRO PASSA-BAIXAS

Low Pass Filter $f_{co} = 24/256$





RESUMO


FONTE
TRANSMISSOR
Forma de onda
Informação
CANAL
RUÍDO
DESTINO
RECEPTOR

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