Coeficientes fourier

Ejecicio a mano

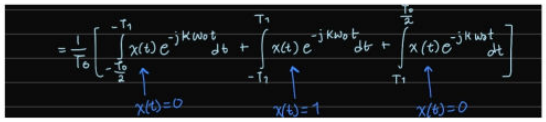
$T = T_0$

$x(t) = \begin{cases} 1, & |t| < T_1 \\ 0, & T_1 < |t| < \frac{T_0}{2} \end{cases}$

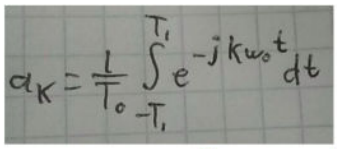
$$a_K = \frac{1}{T_0} \int_{-T_0/2}^{T_0/2} x(t)\, e^{-jk\omega_0 t}\, dt$$

Sustituir x(t) en la integral

$$a_K = \frac{1}{T_0} \int_{\square}^{\square} \square\; e^{-jk\omega_0 t}\, dt$$



Propiedad de Axel



Propiedad de Erick

$\omega_0 = \frac{2\pi}{T_0}$

1

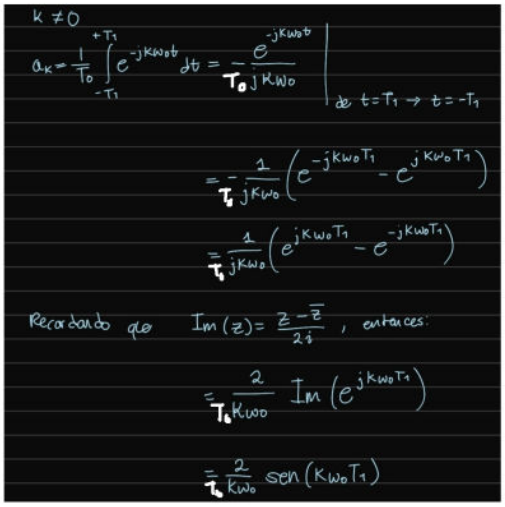
$k = 0$

$k \neq 0$

$a_0 = \frac{1}{T_0}\int_{-T_1}^{T_1} 1\, dt = \frac{1}{T_0}(T_1 + T_1)$

$a_0 = \frac{2T_1}{T_0}$

$a_k = \frac{1}{T_0}\int_{-T_1}^{T_1} e^{-jk\omega_0 t}\, dt$



Propiedad de Axel

$= \frac{2}{T_0 k\omega_0} \operatorname{sin}(k\omega_0 T_1)$

$= \frac{2T_1}{T_0} \frac{\operatorname{sin}(k\omega_0 T_1)}{k\omega_0 T_1}$

$a_k = \frac{2T_1}{T_0} \operatorname{sinc}\{k\omega_0 T_1\}$

$k \neq 0$

Ploteo onda cuadrada

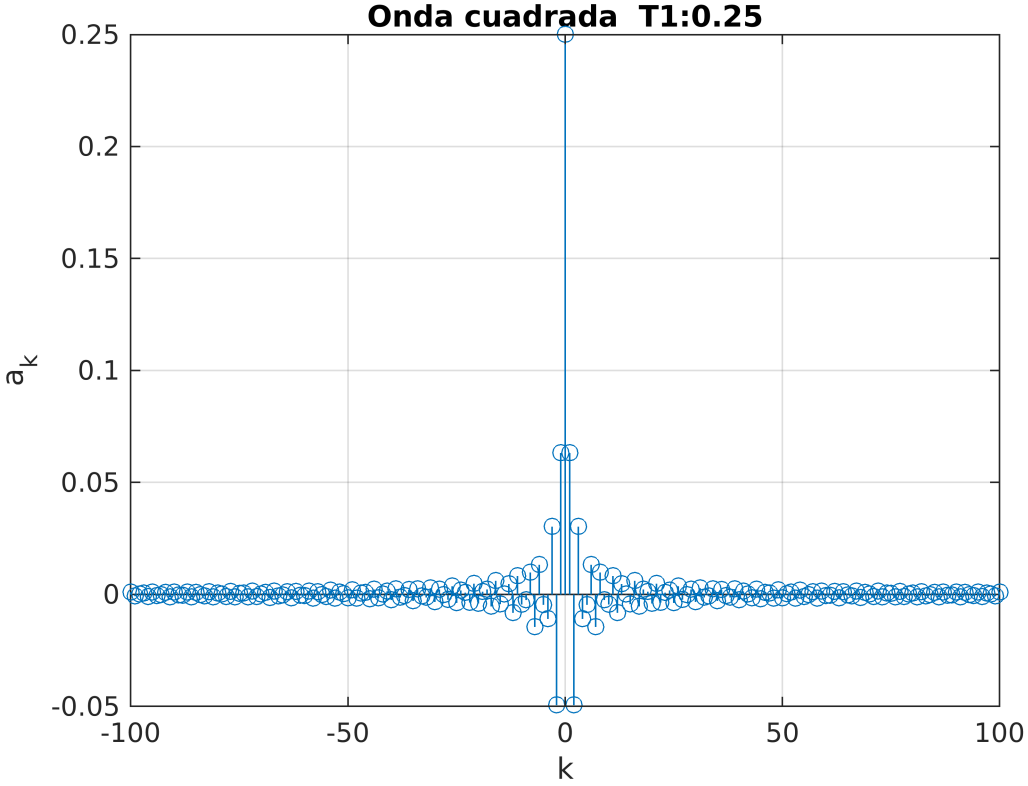
```
N=100;
k=-N:N;

A=8;
T0=2;
T1=T0/A;

w0=2*pi/T0;
```

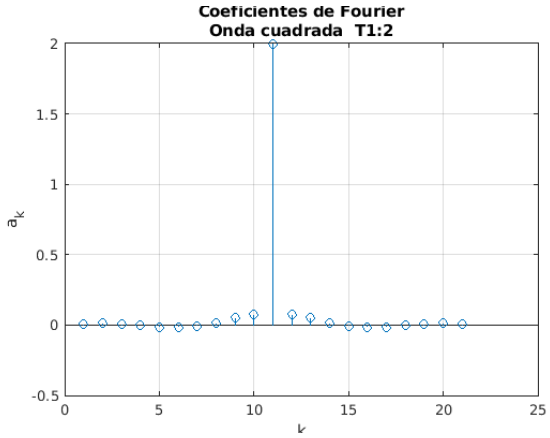
$$a_k = \frac{2T_1}{T_0}\,\mathrm{sinc}\{k w_0 T_1\}$$

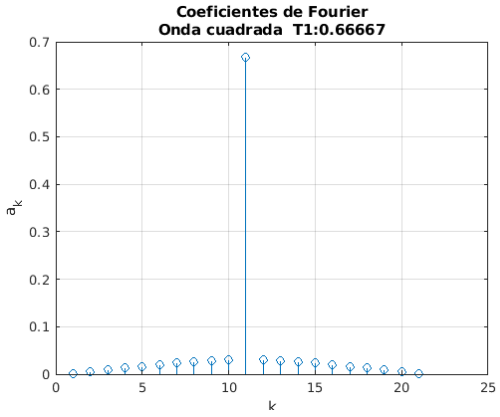
$k \neq 0$

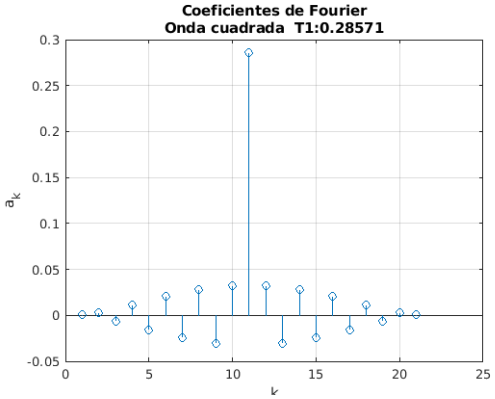
$$a_0 = \frac{2T_1}{T_0}$$

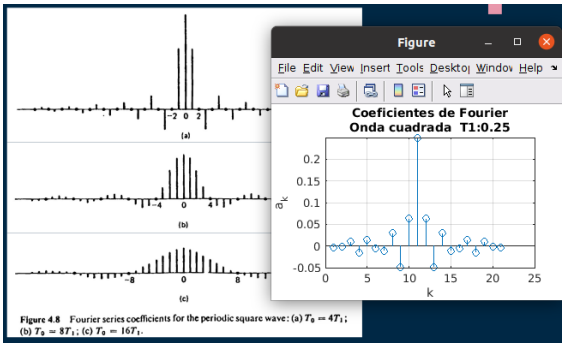
```
a_k=(2*T1/T0)*sinc(k*w0*T1);
a_0=2*T1/T0;

%La ecuación de a_k general no funciona
%Para k=0, por eso sustituimos un valor
%previamente calculado.
a_k(k==0)=a_0;

figure
stem(k,a_k)
xlabel("k")
ylabel("a_k")
grid on
title(["Coeficientes de Fourier";"Onda cuadrada  T1:"+T1])
```


Coeficientes de Fourier
Onda cuadrada T1:0.25
0.25
0.2
0.15
0.1
0.05
0
-0.05
a_k
-100
-50
0
50
100
k


Coeficientes de Fourier
Onda cuadrada T1:2
2
1.5
1
0.5
0
-0.5
a_k
0
5
10
15
20
25
k


Coeficientes de Fourier
Onda cuadrada T1:0.66667
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
a_k
0
5
10
15
20
25
k

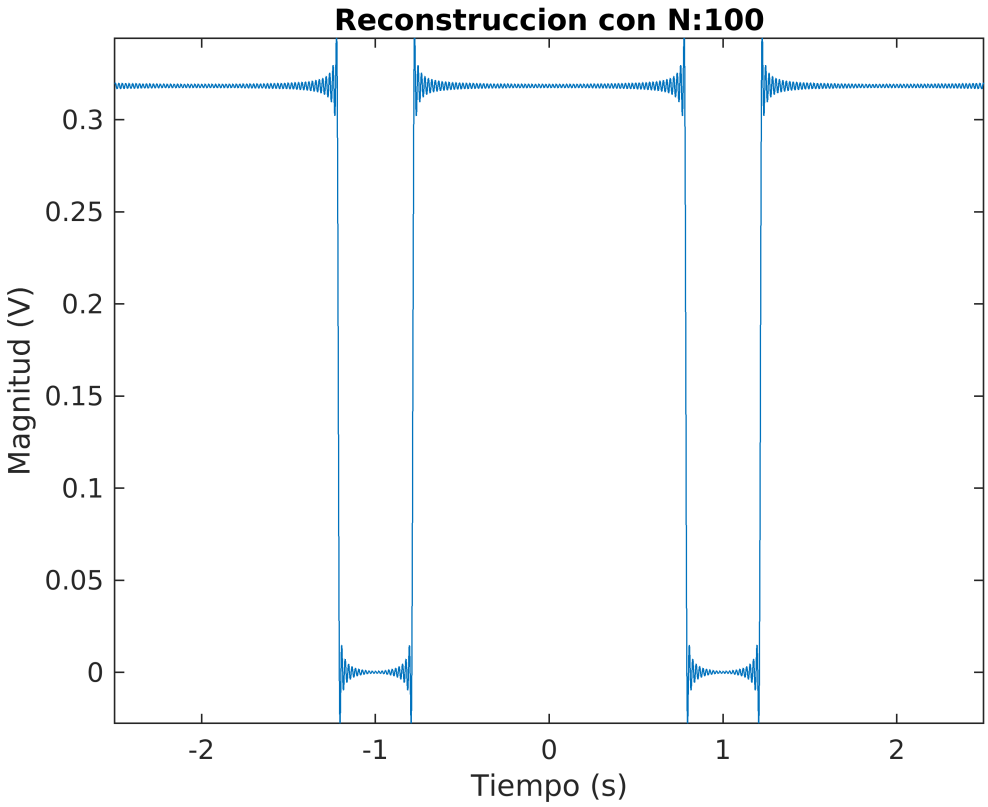

Coeficientes de Fourier
Onda cuadrada T1:0.28571
0.3
0.25
0.2
0.15
0.1
0.05
0
-0.05
a_k
0
5
10
15
20
25
k

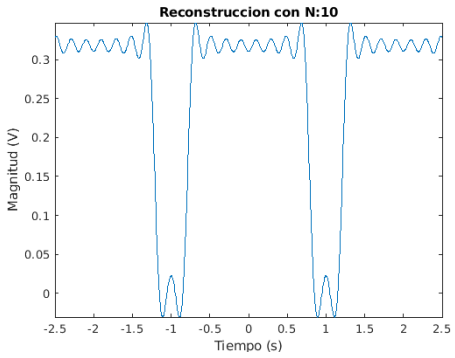


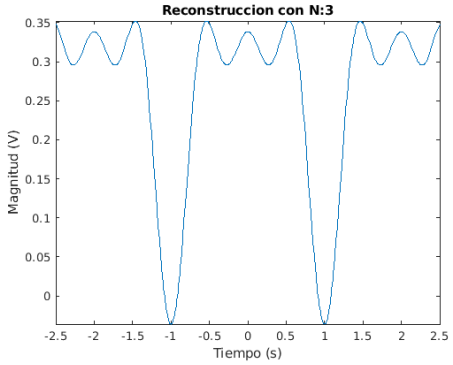
Síntesis

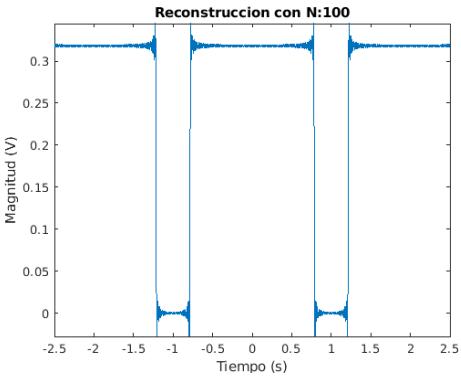
$$x(t) = \sum_{k=-\infty}^{\infty} a_k e^{jk\Omega_0 t}, \quad t \in [t_0, t_0 + T],$$

```
syms t
n=-3:3;
% %Numero de elementos
% numel()
% %Tamaño de la matriz en n X m
% size()
% %Tamaño más grande de la matriz
% length()

x=sum(a_k.*exp(1i*k*w0*t));


figure
fplot(x,[-2.5 2.5])
xlabel("Tiempo (s)")
ylabel("Magnitud (V)")
title("Reconstruccion con N:"+N)
```


Reconstruccion con N:100
Magnitud (V)
Tiempo (s)


Reconstruccion con N:10
Magnitud (V)
Tiempo (s)


Reconstruccion con N:3
Magnitud (V)
Tiempo (s)


Reconstruccion con N:100
Magnitud (V)
Tiempo (s)