

Entre Rayos, Señales y Ruido

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#LaUISqueQueremos



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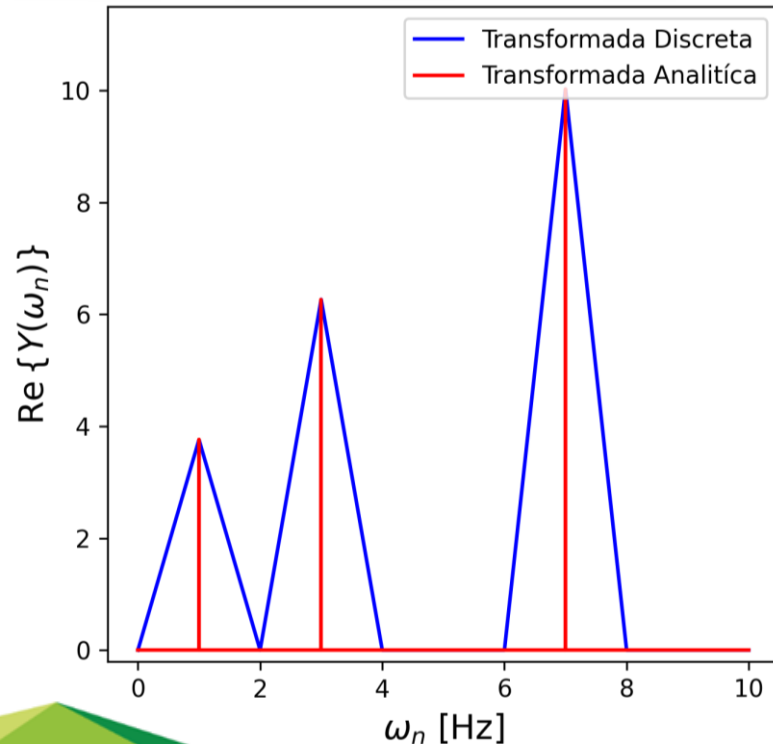


Parte Real e Imaginaria de la Transformada de Fourier

$$\mathcal{F}\{y(t)\} = \int_{-\infty}^{\infty} dt \frac{e^{-ist}}{\sqrt{2\pi}} y(t)$$

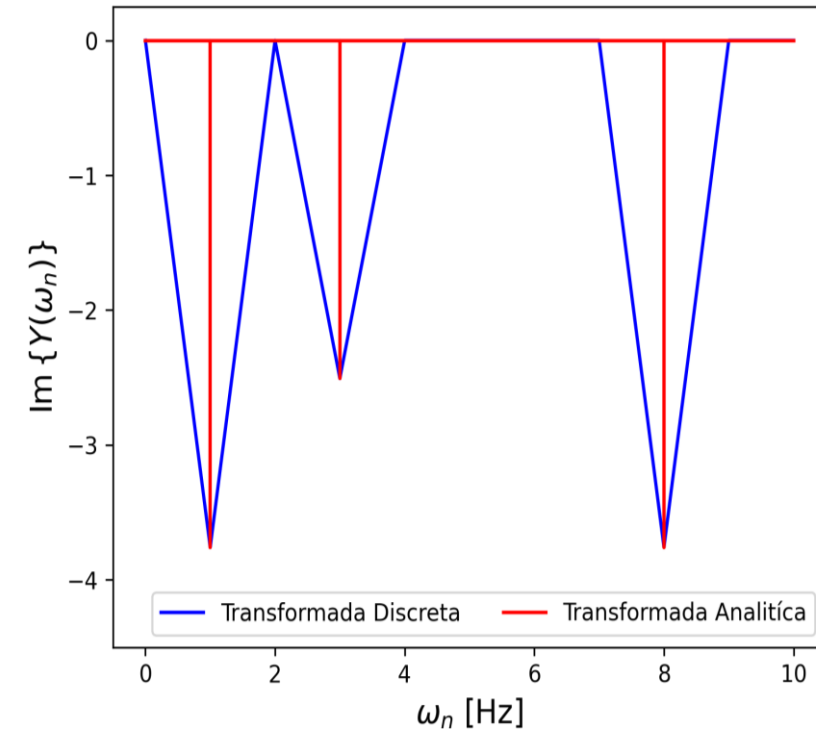
Señal de Cosenos

$$\mathcal{F}\{3 \cos(\omega t) + 5 \cos(3\omega t) + 8 \cos(7\omega t)\} = \frac{\sqrt{2\pi}}{2} [3\delta(s-1) + 3\delta(s+1) + 5\delta(s-3) + 5\delta(s+3) + 8\delta(s-7) + 8\delta(s+7)]$$



Señal de Senos

$$\mathcal{F}\{3 \sin(\omega t) + 2 \sin(3\omega t) + 3 \sin(8\omega t)\} = \frac{\sqrt{2\pi}i}{2} [-3\delta(s-1) + 3\delta(s+1) - 2\delta(s-3) + 2\delta(s+3) - 3\delta(s-8) + 3\delta(s+8)]$$



$$\mathcal{F}^{-1}\{\sqrt{2\pi}a\delta(s-b)\} = \int_{-\infty}^{\infty} ds \frac{e^{ist}}{\sqrt{2\pi}} a\sqrt{2\pi}\delta(s-b) = a \int_{-\infty}^{\infty} ds e^{ist}\delta(s-b) = a e^{ist}|_{s=b} = a e^{ibt}$$

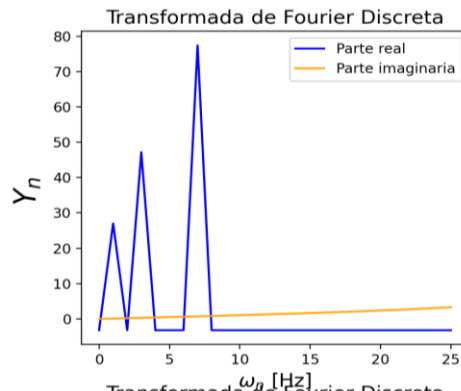
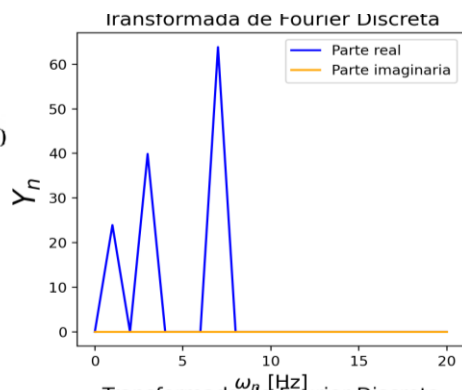
Variación de parámetros Transformada Discreta

$$y_1(t) = 3 \cos(\omega t) + 5 \cos(3\omega t) + 8 \cos(7\omega t)$$

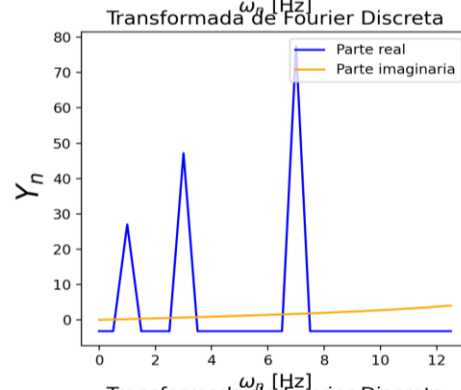
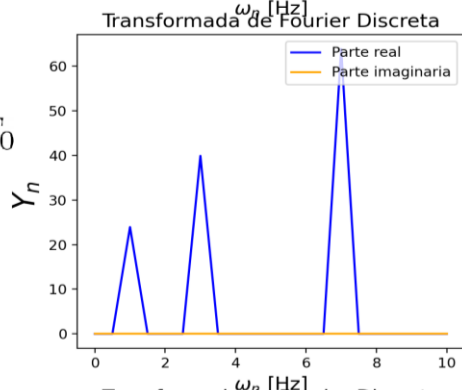
$N = 40$

$N = 50.5$

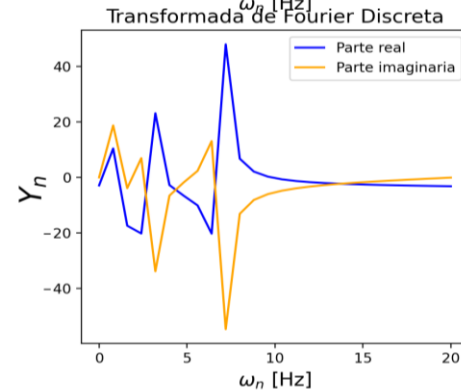
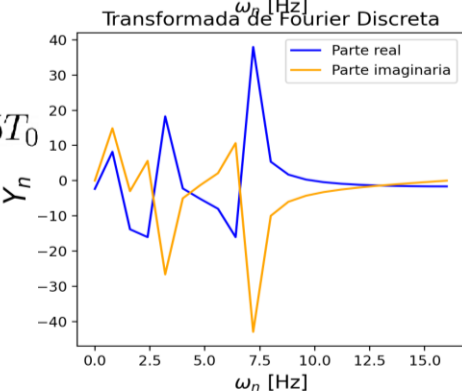
$T = T_0$



$T = 2T_0$

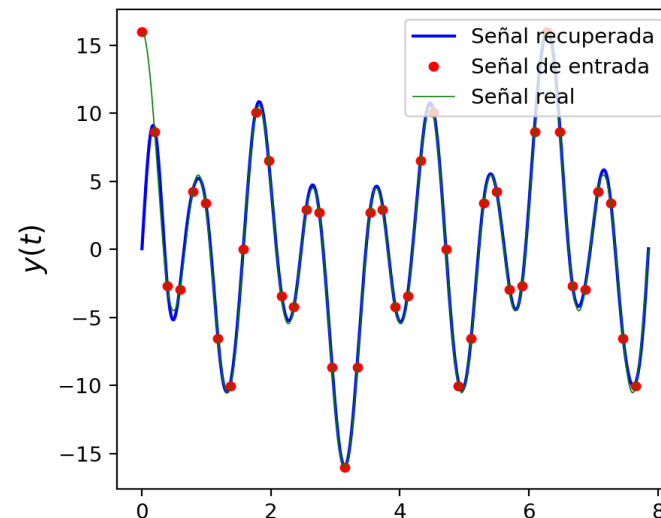


$T = 1.25T_0$



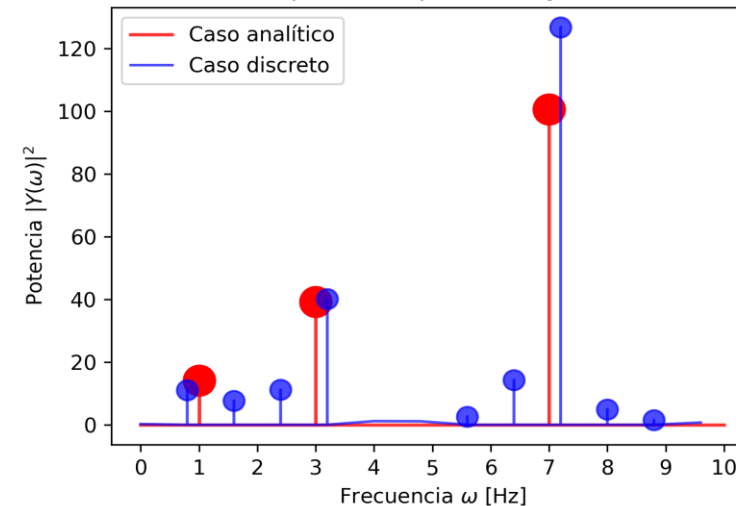
$$T = 1.25T_0 \quad N = 40$$

Transformada de Fourier Discreta Inversa



$$\text{espectro}(s) = |Y(s)|^2$$

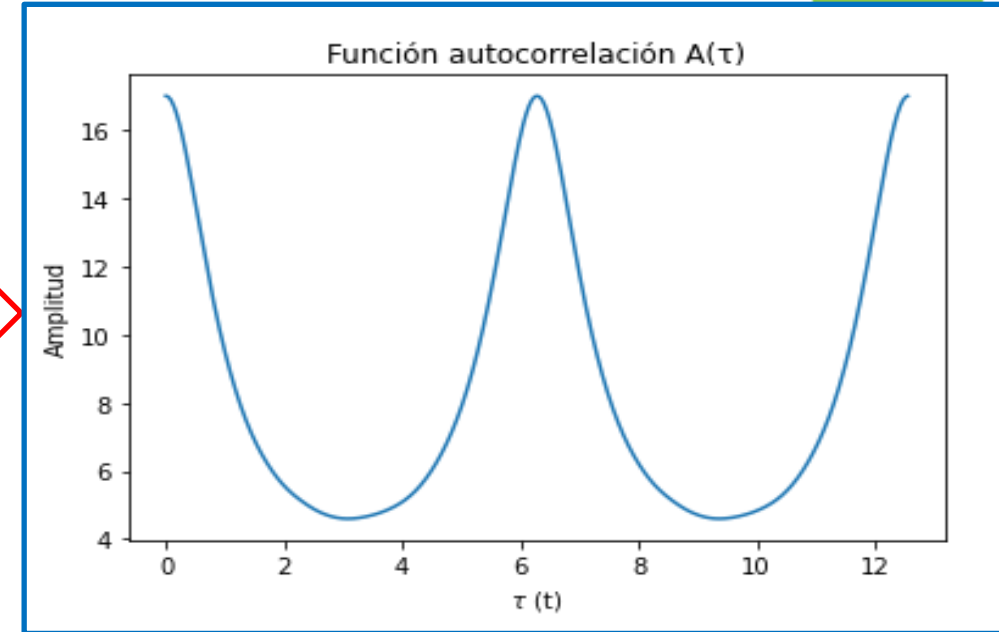
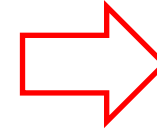
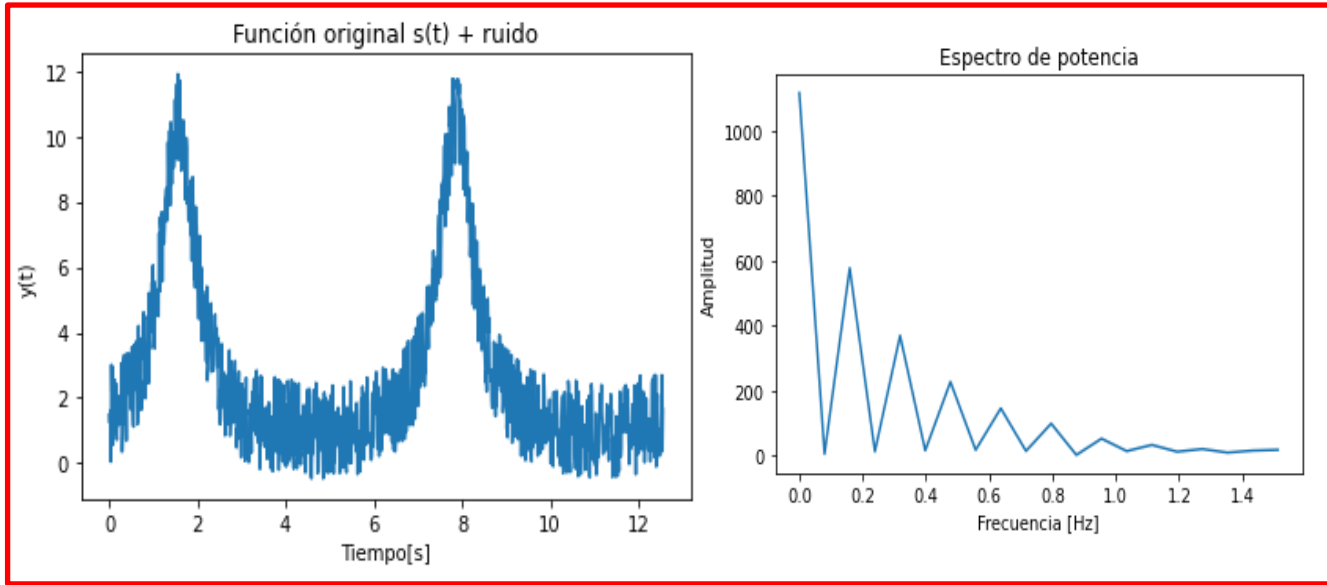
Espectro de potencias $y_1(t)$



Autocorrelación señal ruidosa

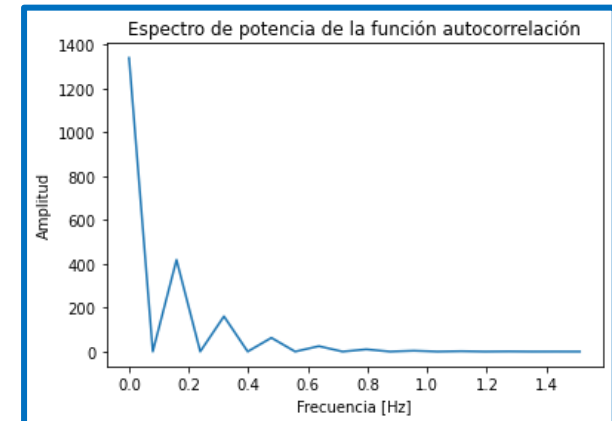


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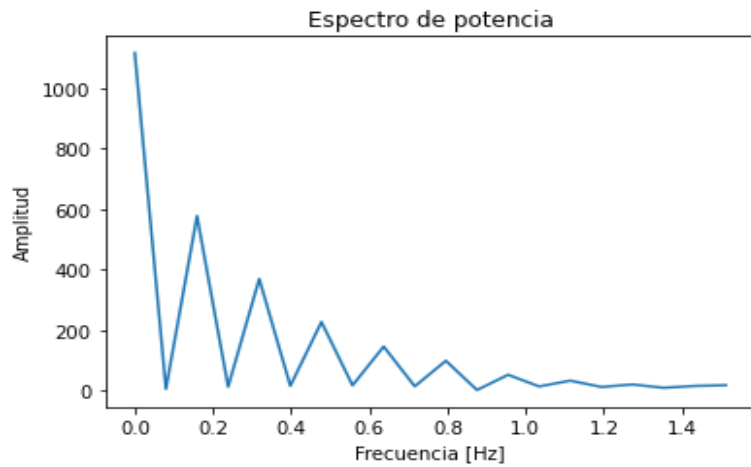
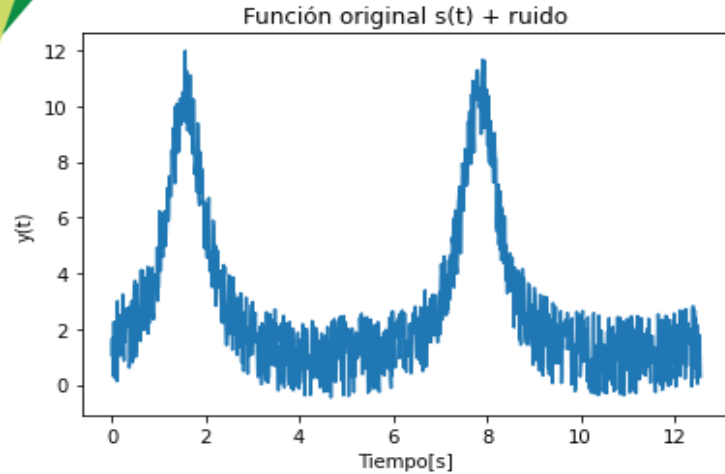
$$A(\tau) = \int_{-\infty}^{+\infty} dy^*(t)y(t+\tau) = \int_{-\infty}^{+\infty} dy^*(t-\tau)y(t)$$

$$A(\omega) = \sqrt{2\pi}|S(\omega)|^2$$

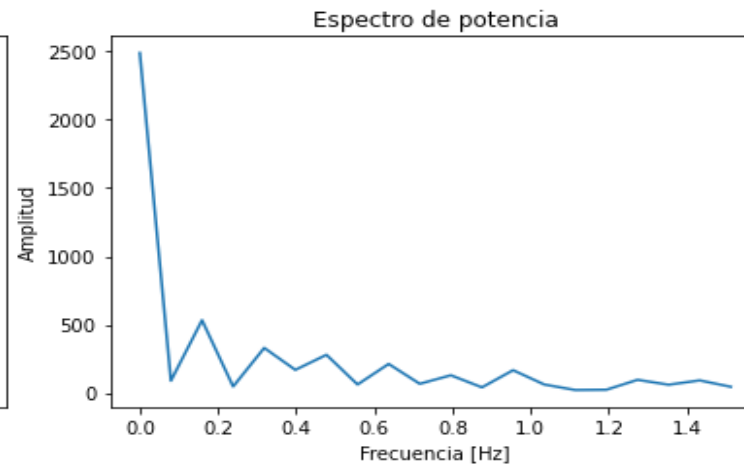
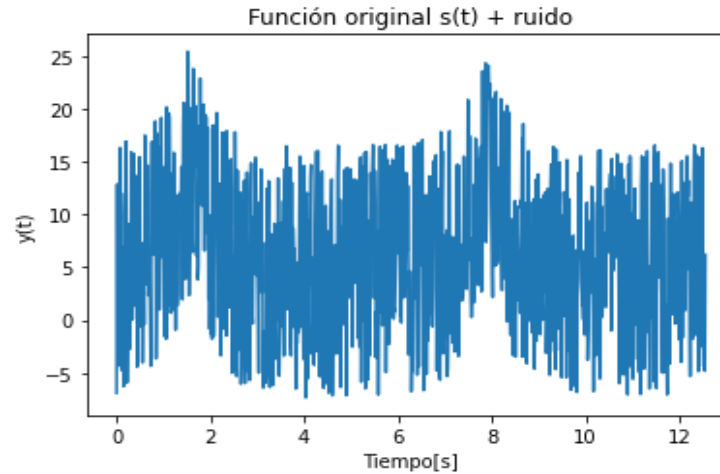


Variabilidad del Ruido

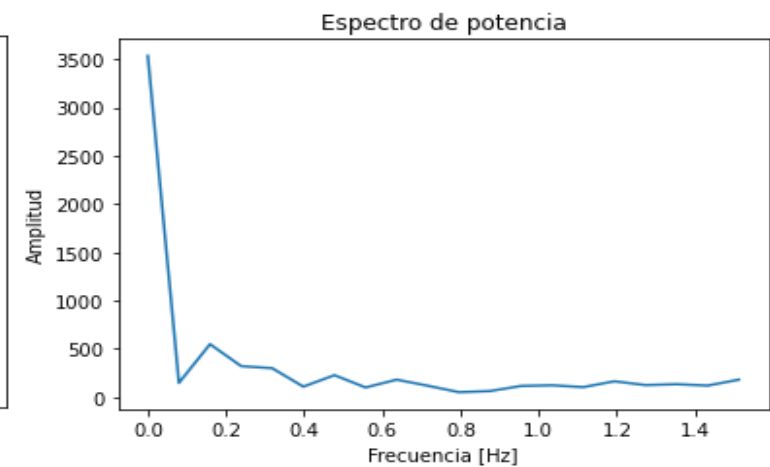
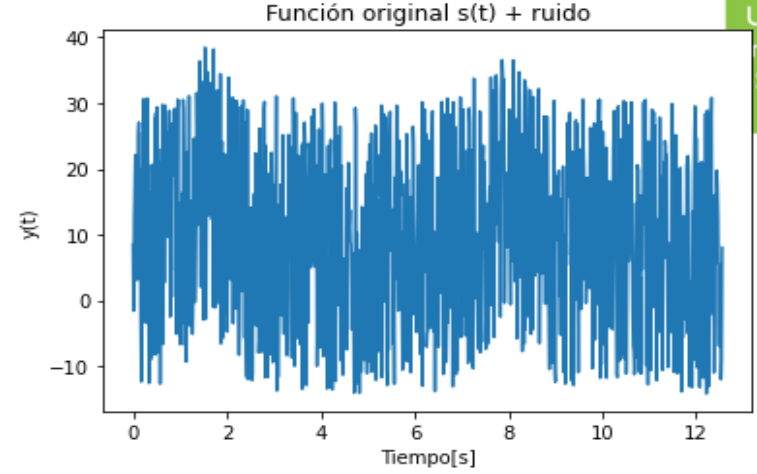
$\alpha = 1$



$\alpha = 8$



$\alpha = 15$

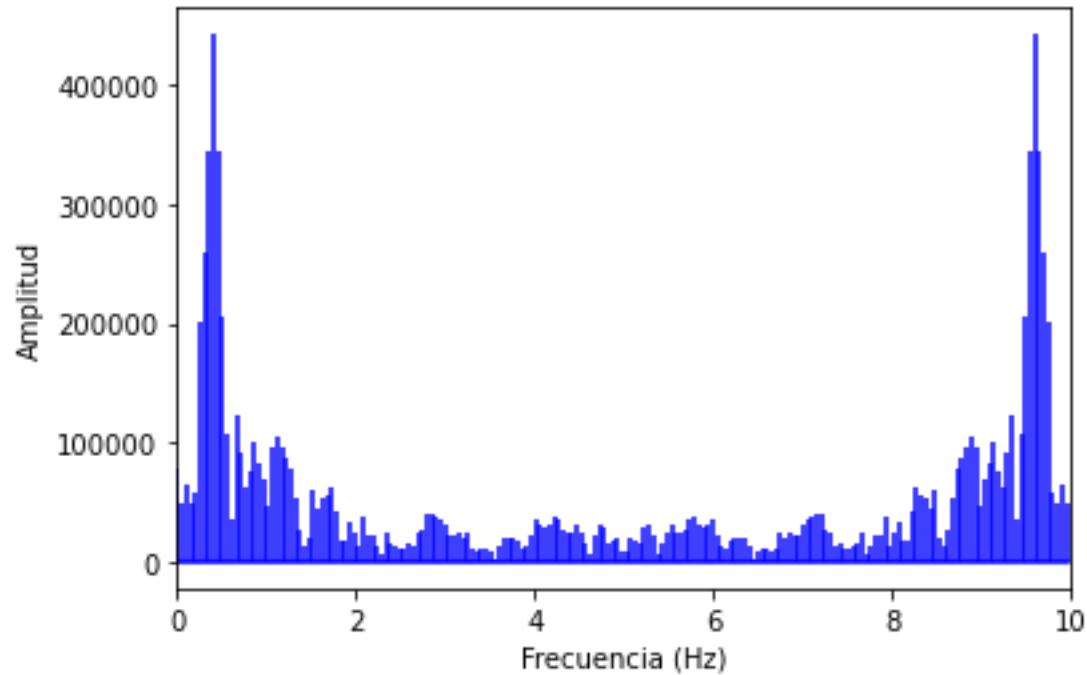


$$y(t_i) = \frac{10}{10 - 9 \sin(t_i)} + \alpha(3\mathcal{R}_i - 1)$$

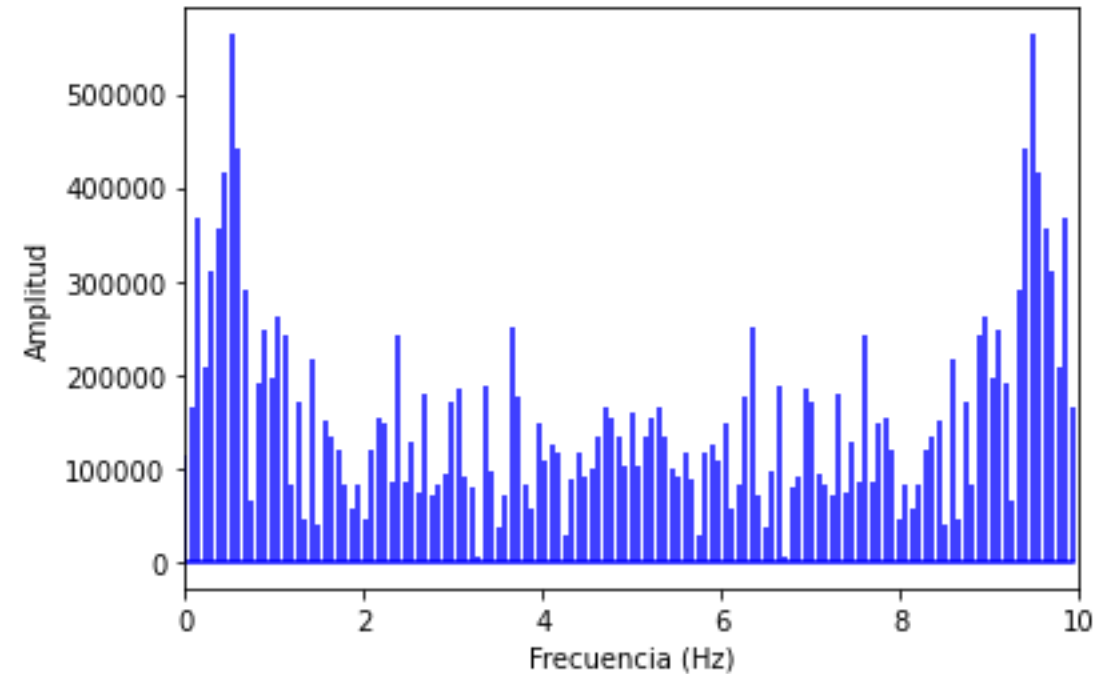
$$d = \sqrt{\int_0^T (f(x) - g(x))^2 dx}$$

Transformada de Fourier de un Elve

Antena 1



Antena 2



$$Y_n \equiv \frac{1}{h} Y(s_n) = \sum_{k=1}^N y_k \frac{e^{-2\pi i k n / N}}{\sqrt{2\pi}}, \quad \text{con } n = 0, 1, \dots, N.$$



Gracias!

