



Tratamiento de Señales

Version 2022-I

Muestreo en 1D y en 2D

[Capítulo 4]

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Recordatorio

$$f(t) * \delta(t) = f(t)$$

La convolución de una señal por el impulso
es la misma señal

Recordatorio

$$f(t) * g(t) \quad \circ \text{---} \bullet \quad F(\omega)G(\omega)$$

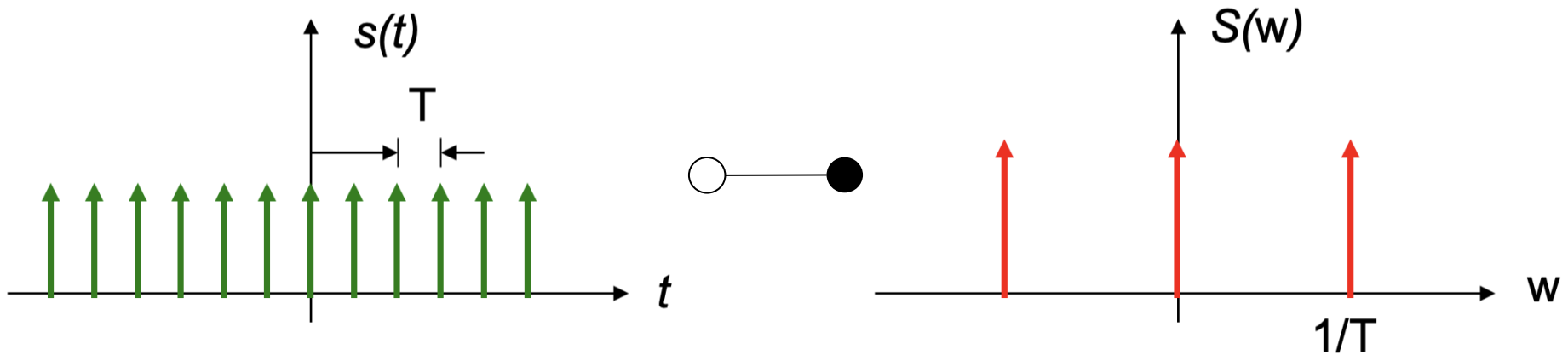
La transformada de Fourier de la convolución de dos señales es la multiplicación de sus transformadas de Fourier

Recordatorio

$$f(t)g(t) \quad \circ \text{---} \bullet \quad F(\omega) * G(\omega)$$

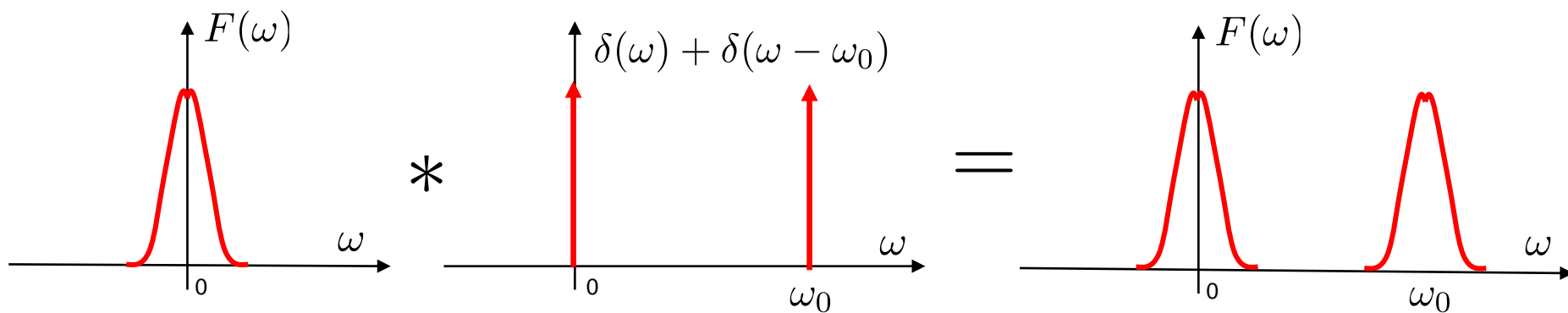
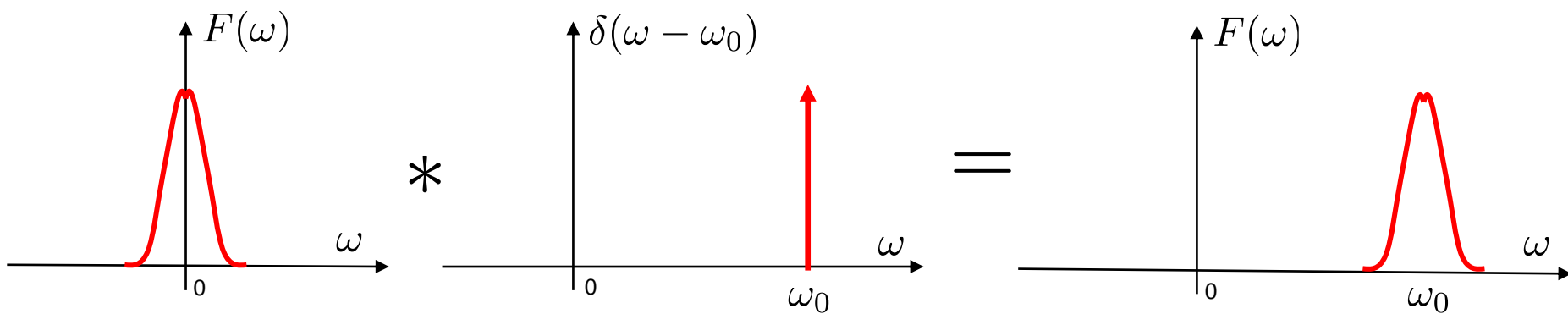
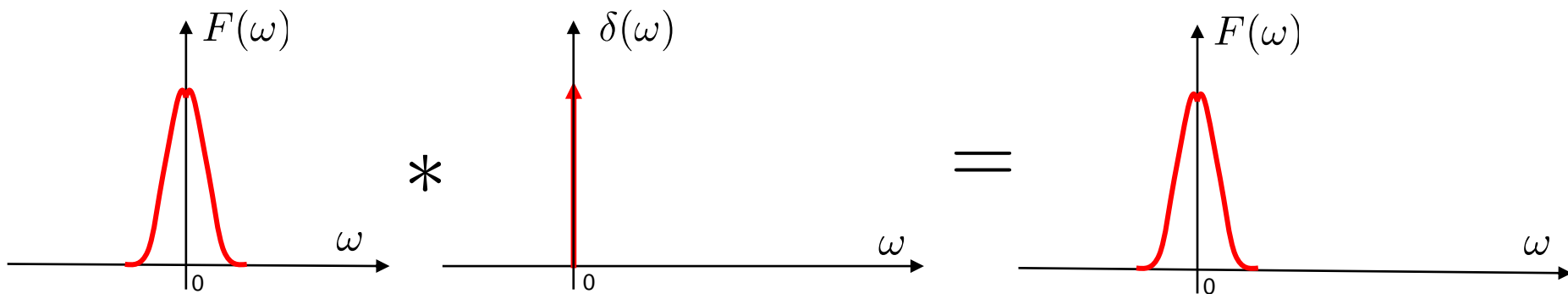
La transformada de Fourier de la multiplicación de dos señales
es la convolución de sus transformadas de Fourier

Recordatorio

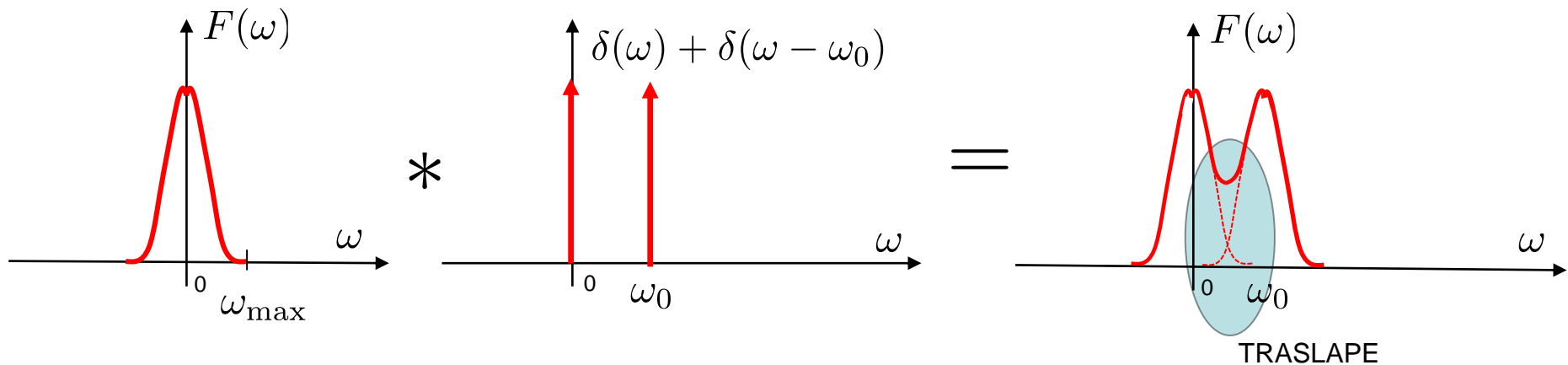
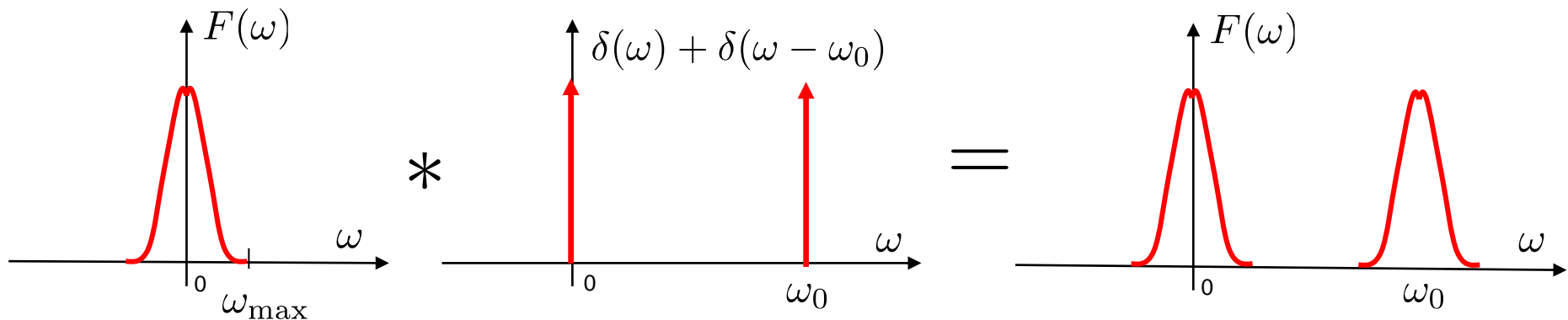


La transformada de Fourier de un tren de impulsos de periodo T
es un tren de impulsos de periodo $1/T$

[Muestreo en 1D]

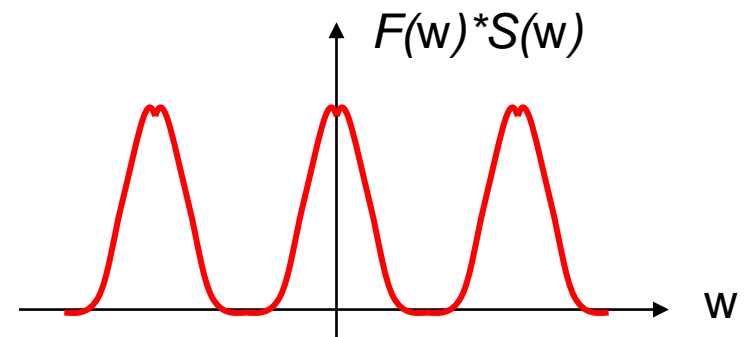
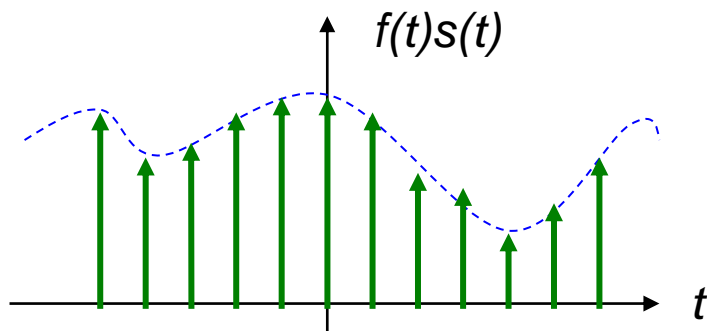
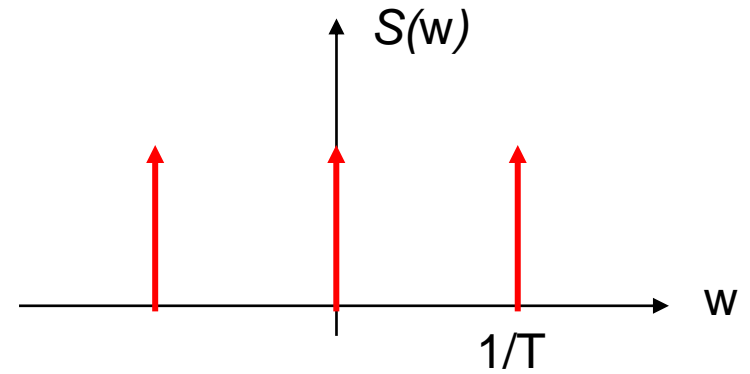
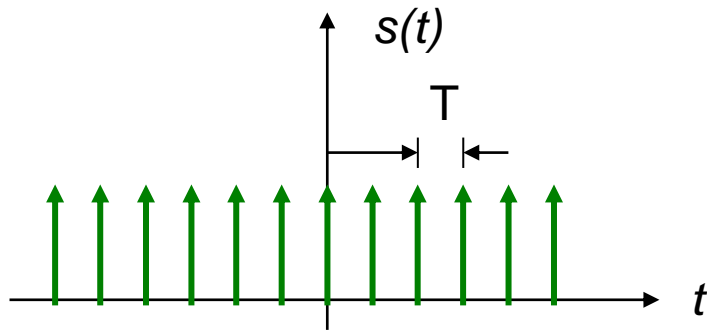
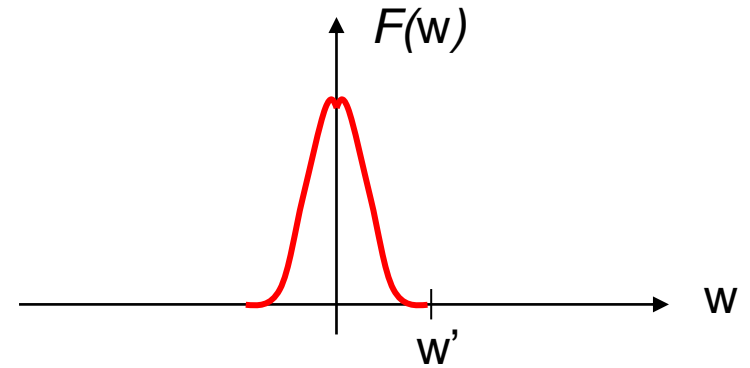
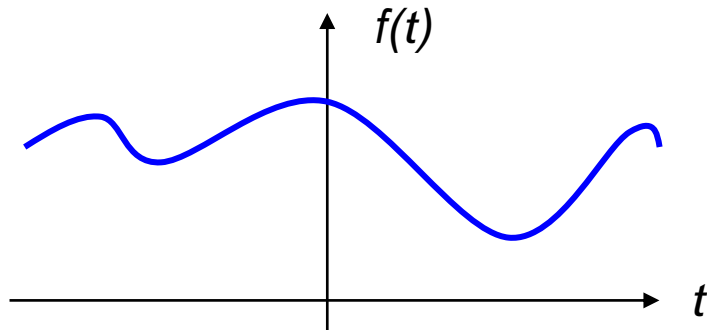


[Muestreo en 1D]

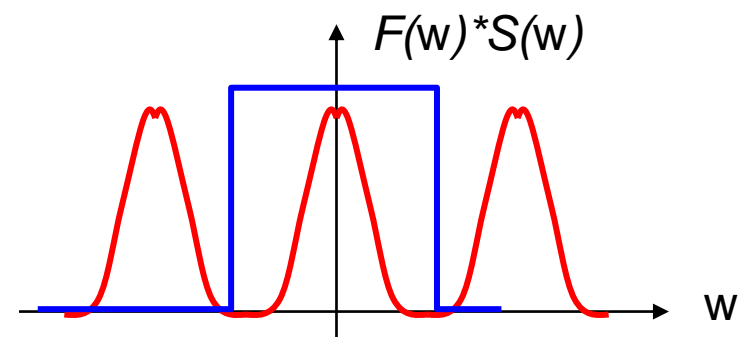
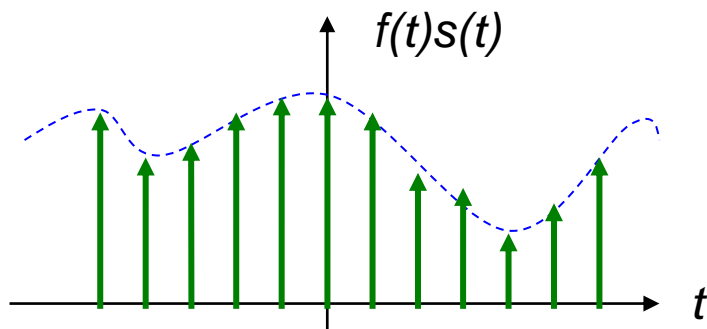
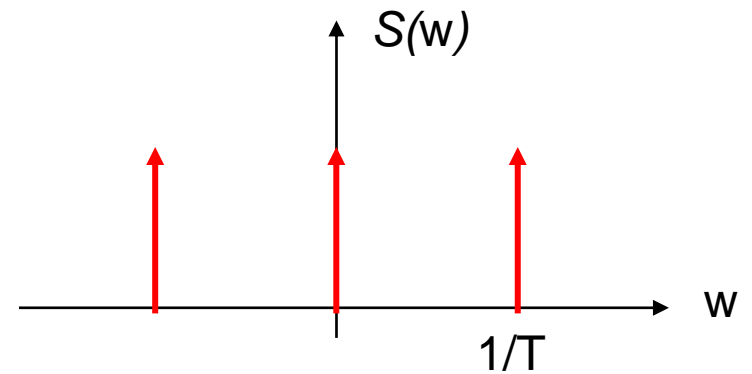
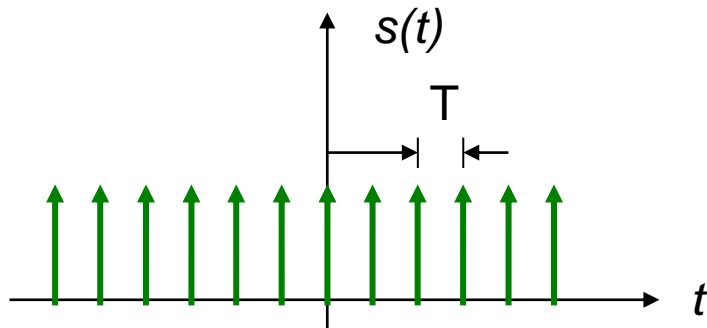
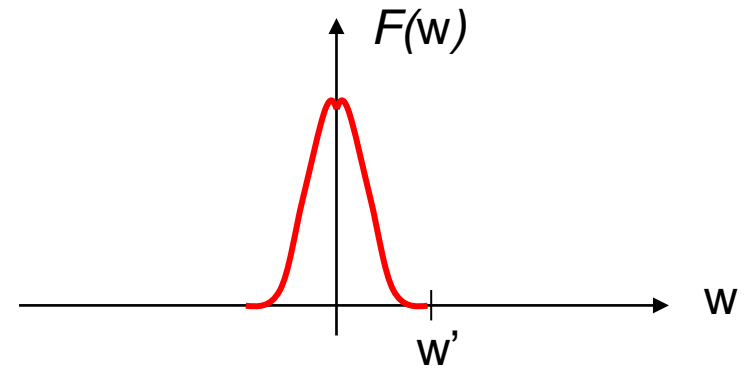
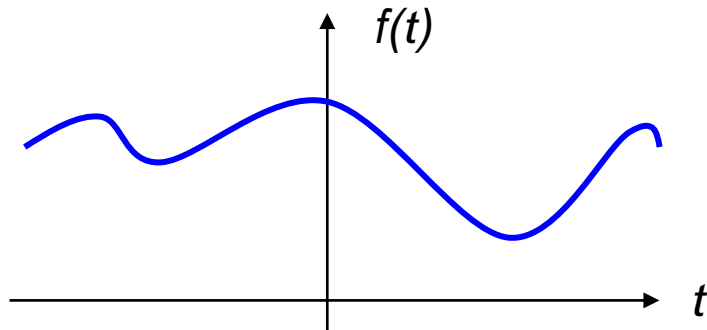


Si $\omega > 2\omega_{\max}$ no hay traslape

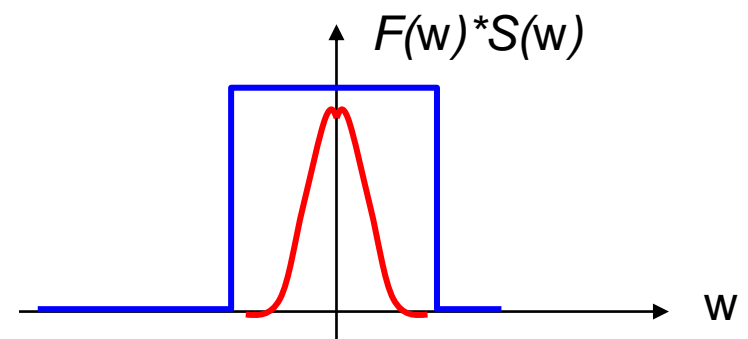
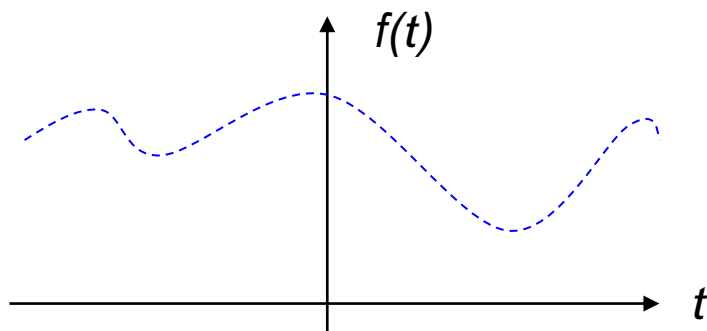
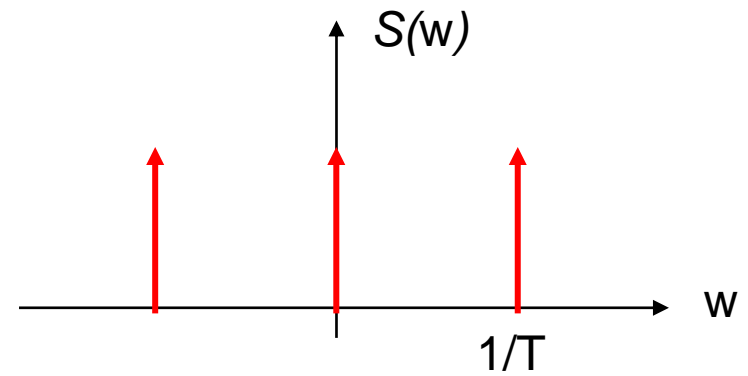
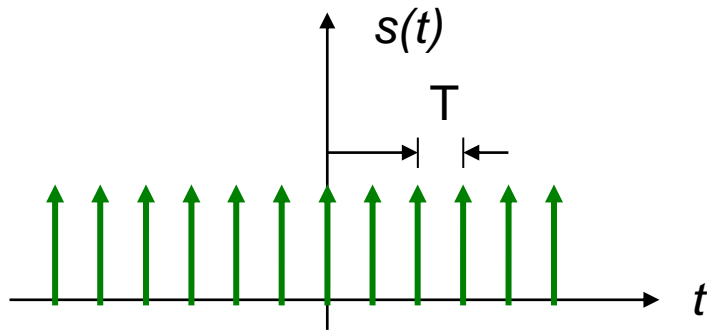
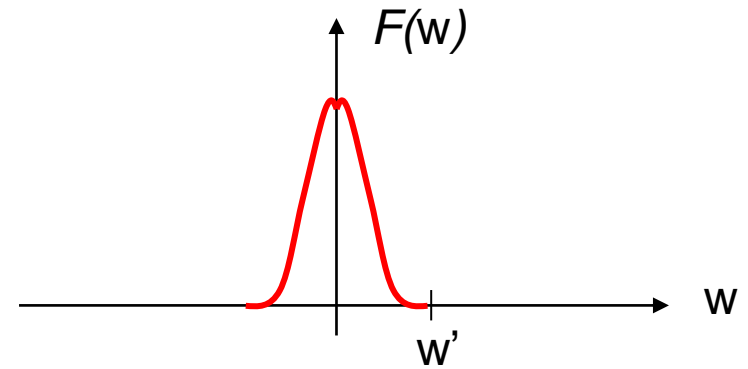
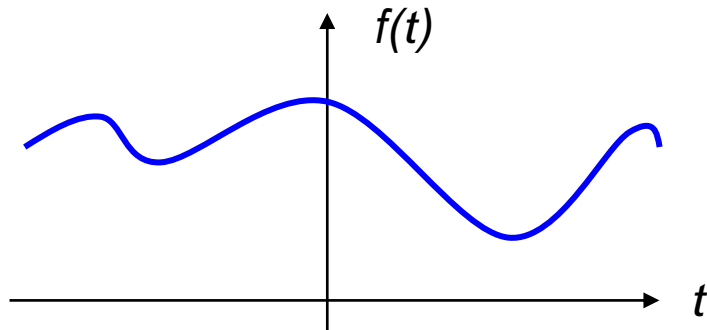
[Muestreo en 1D]



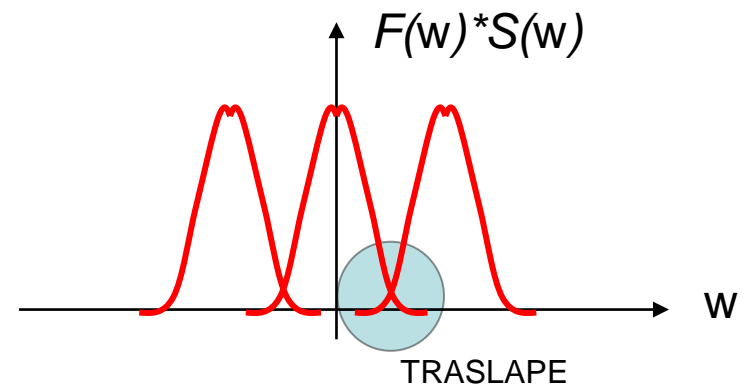
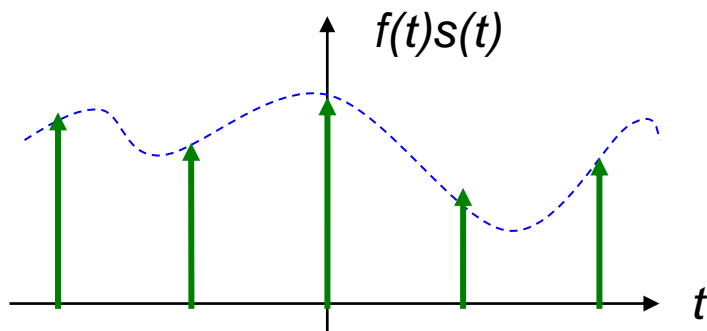
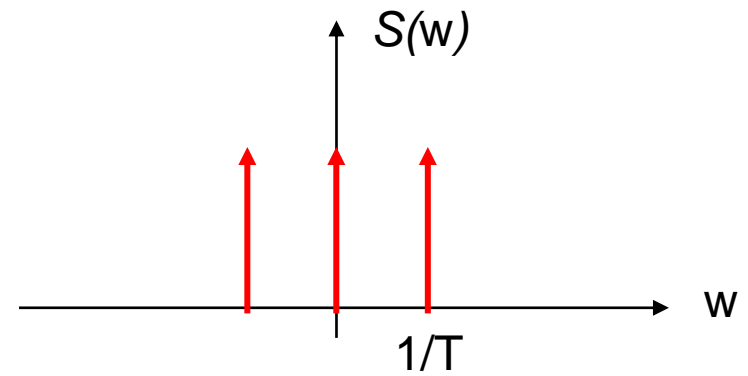
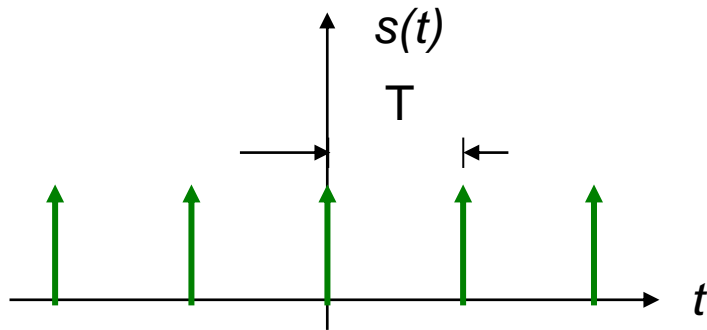
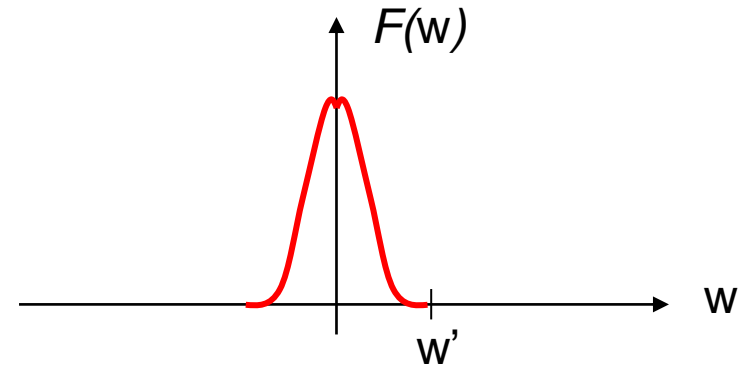
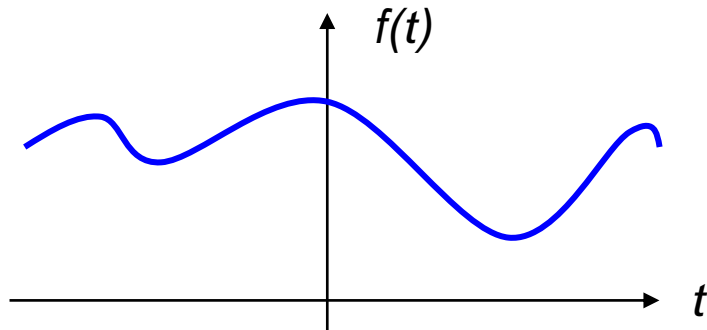
[Muestreo en 1D]



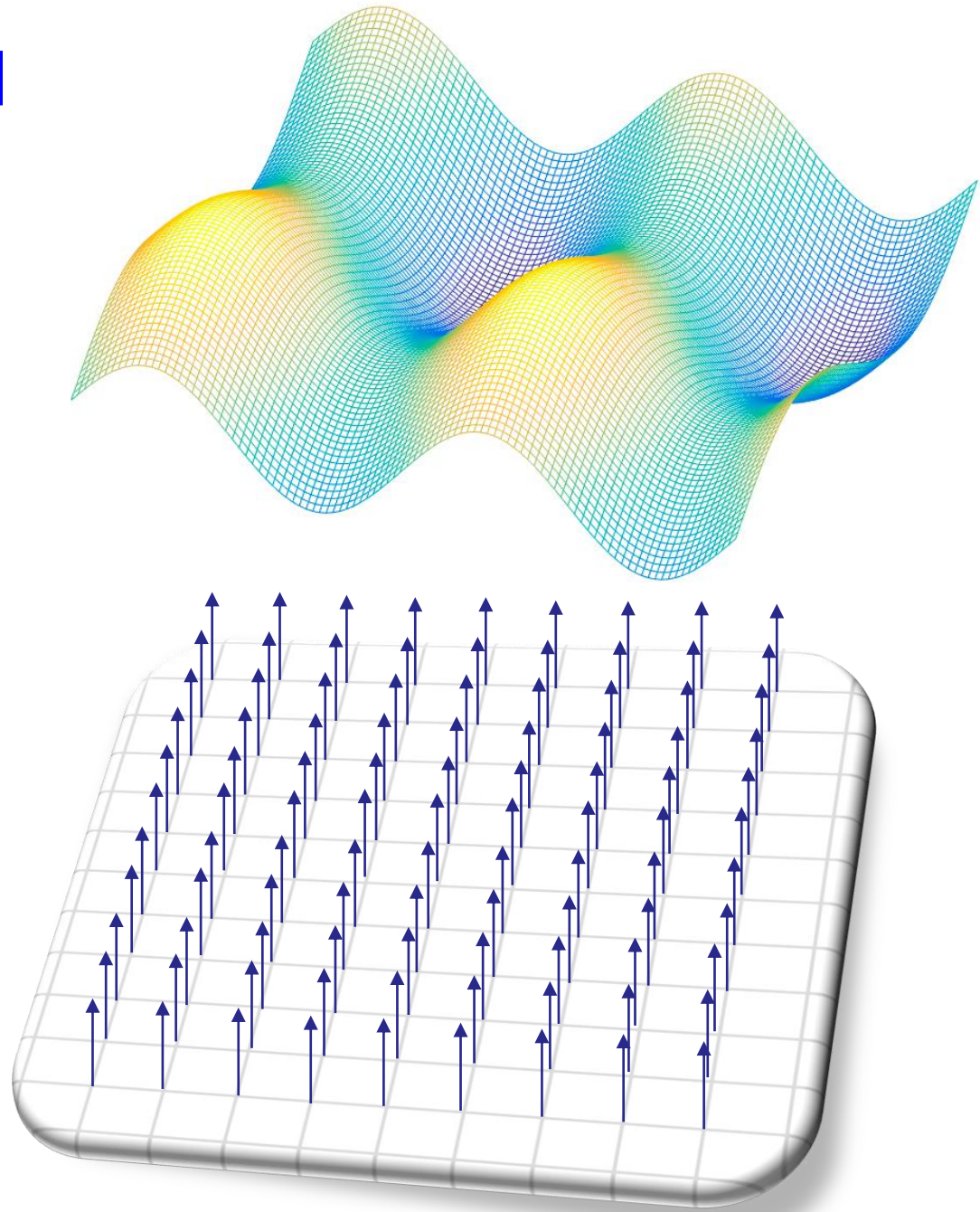
[Muestreo en 1D]



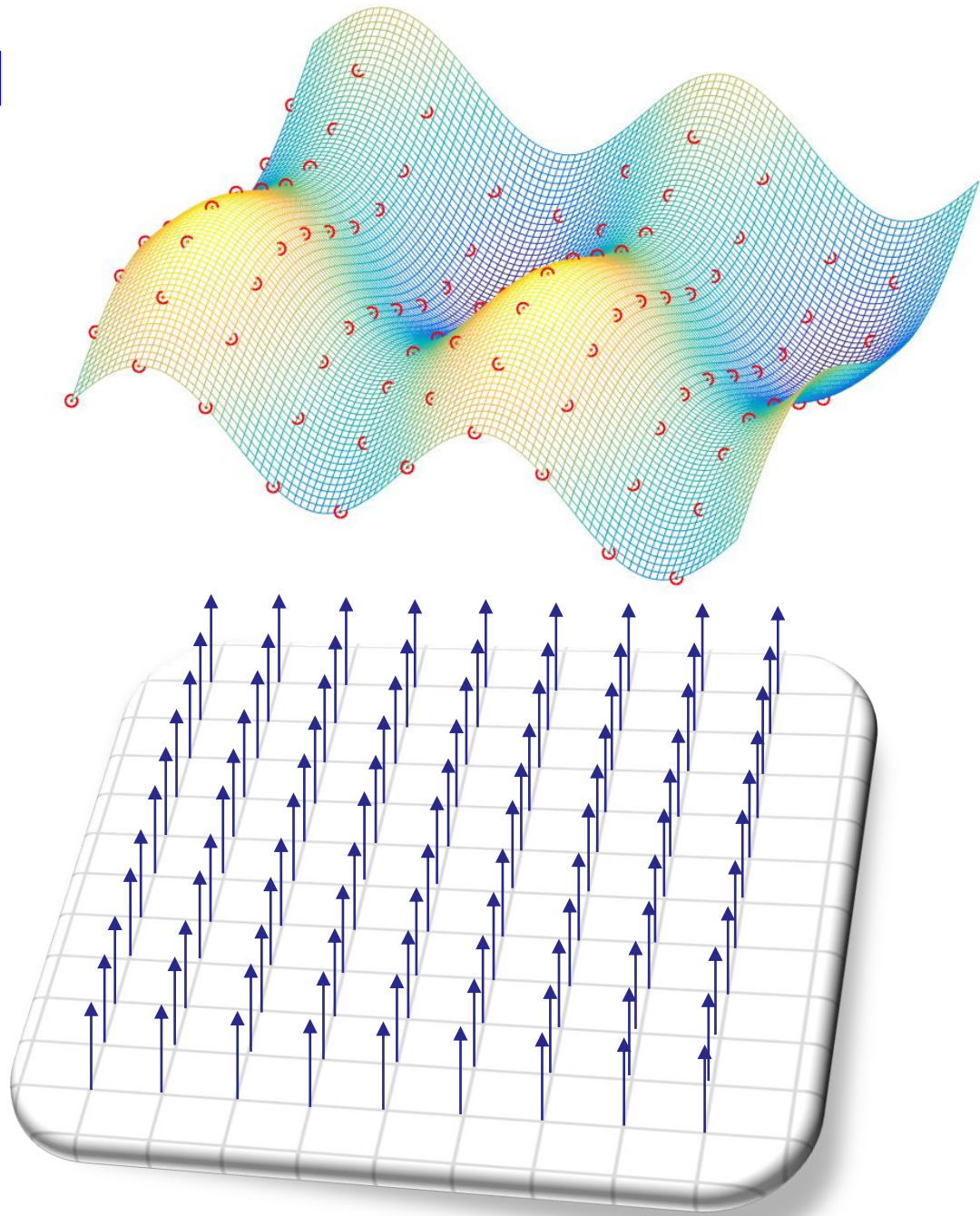
[Muestreo en 1D]



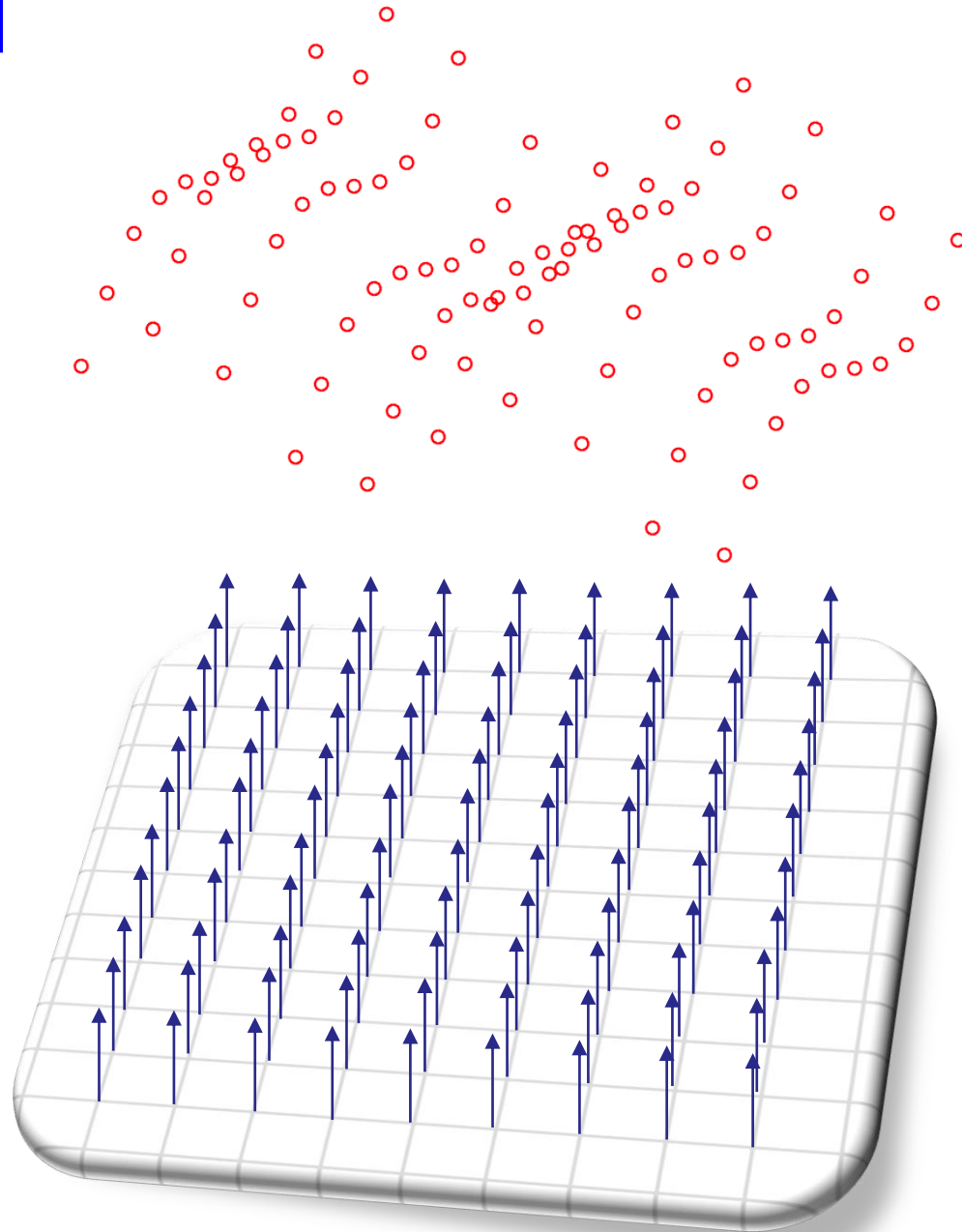
[Muestreo en 2D]



[Muestreo en 2D]

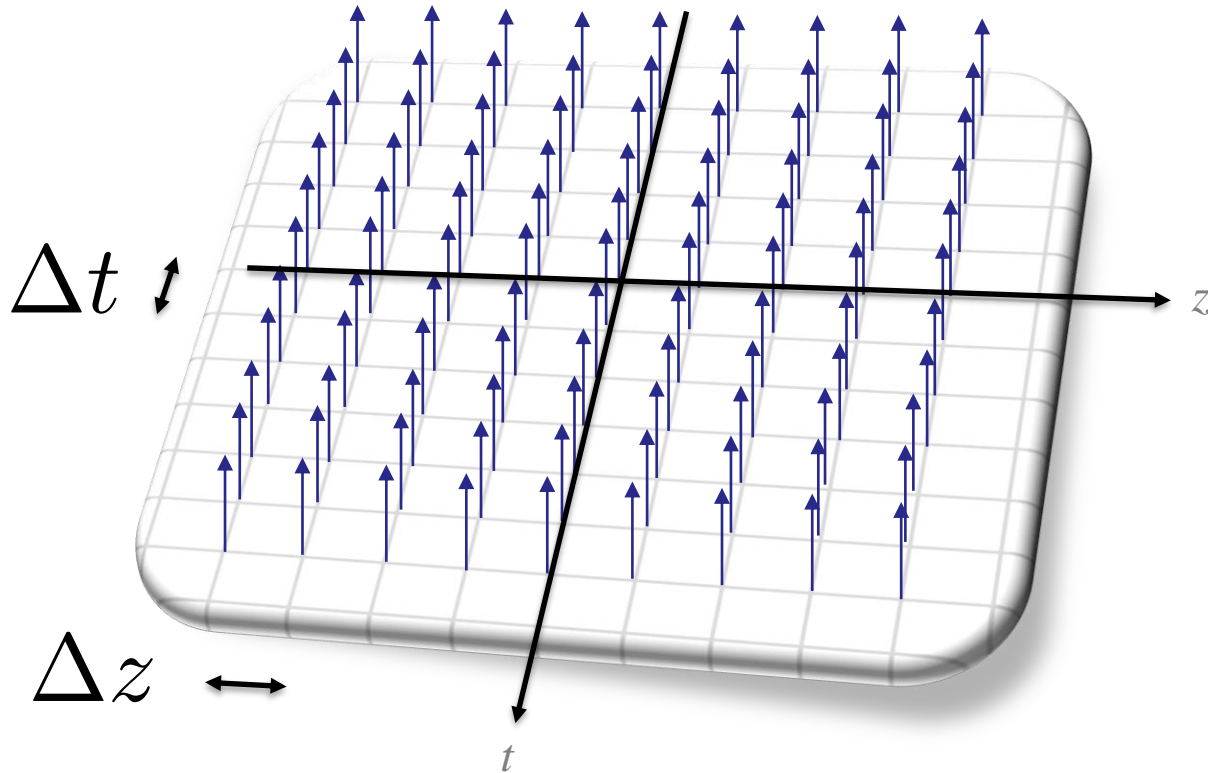


[Muestreo en 2D]



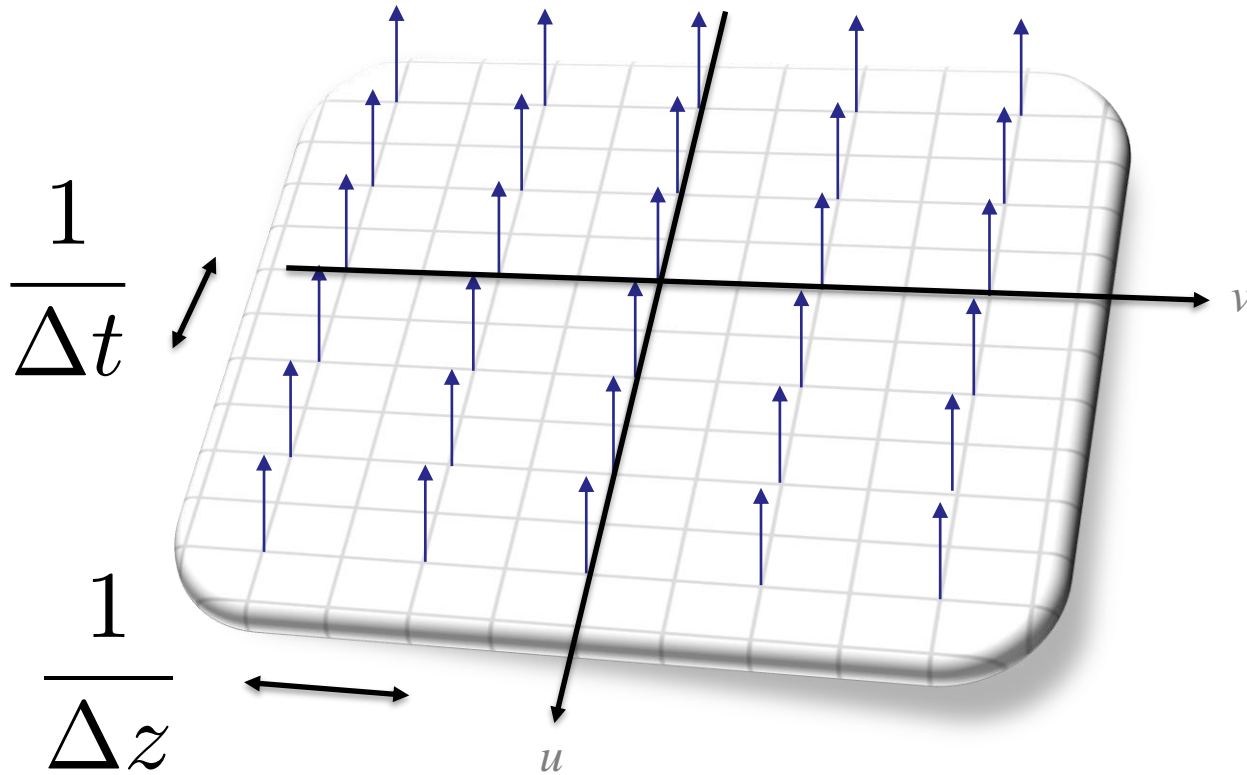
[Transformada de un tren de impulsos en 2D]

Dominio del espacio:



[Transformada de un tren de impulsos en 2D]

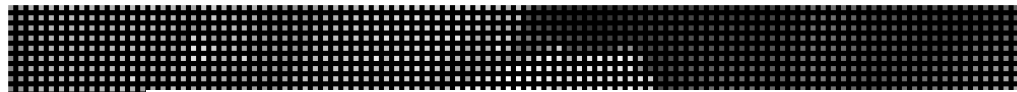
Dominio de la frecuencia:



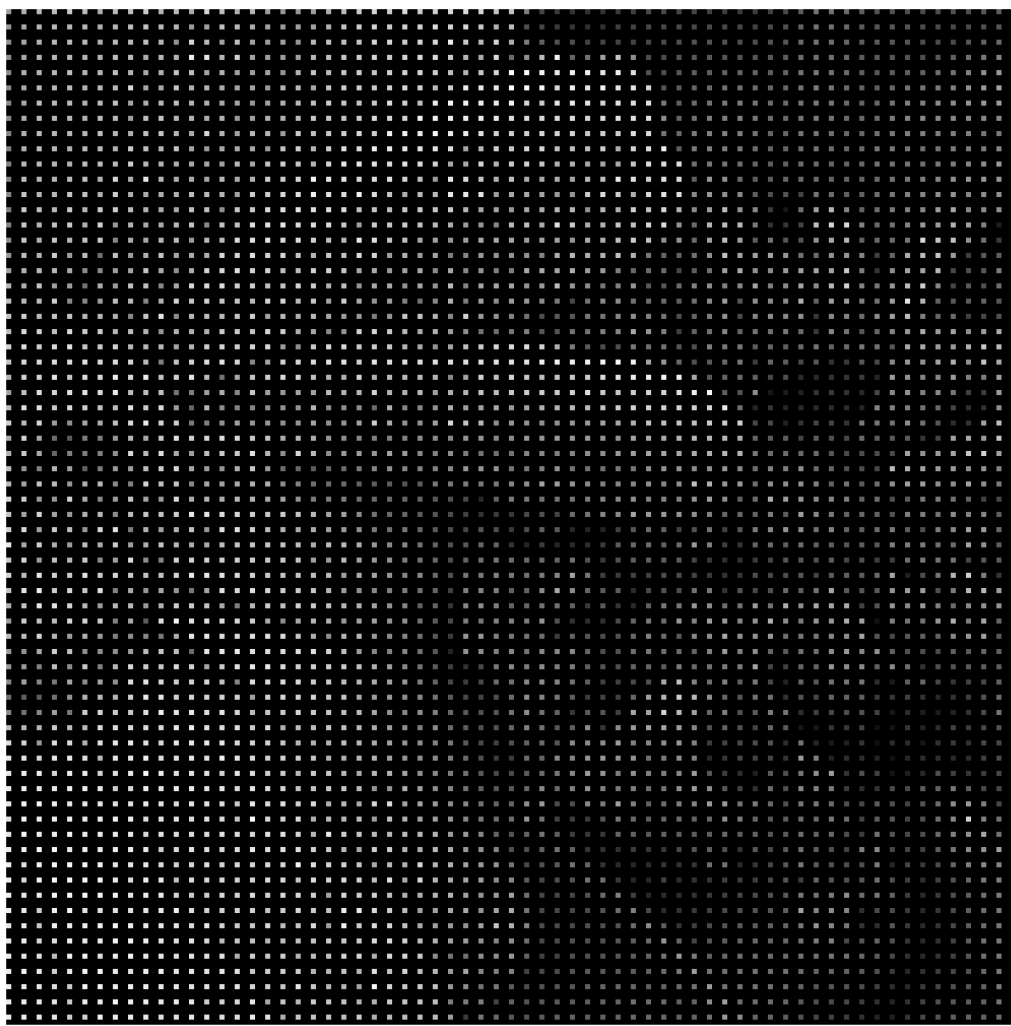
[Muestreo en 2D]



original



muestreo cada 2 pixeles



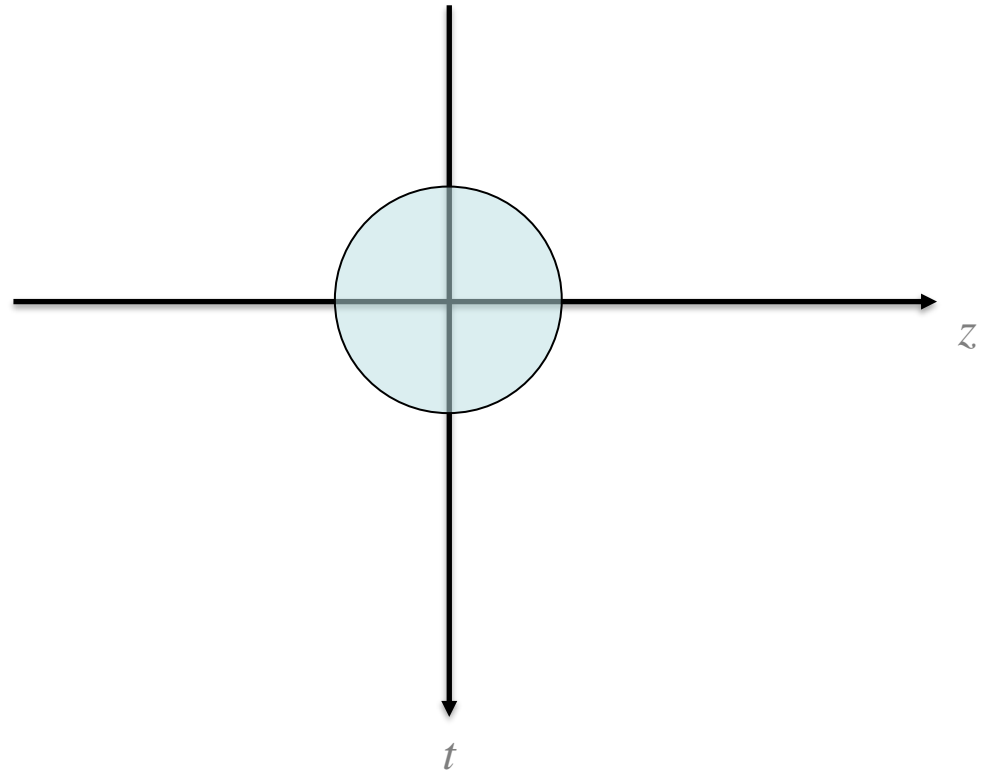
muestreo cada 3 pixeles

[Muestreo en 2D]

Dominio del Espacio

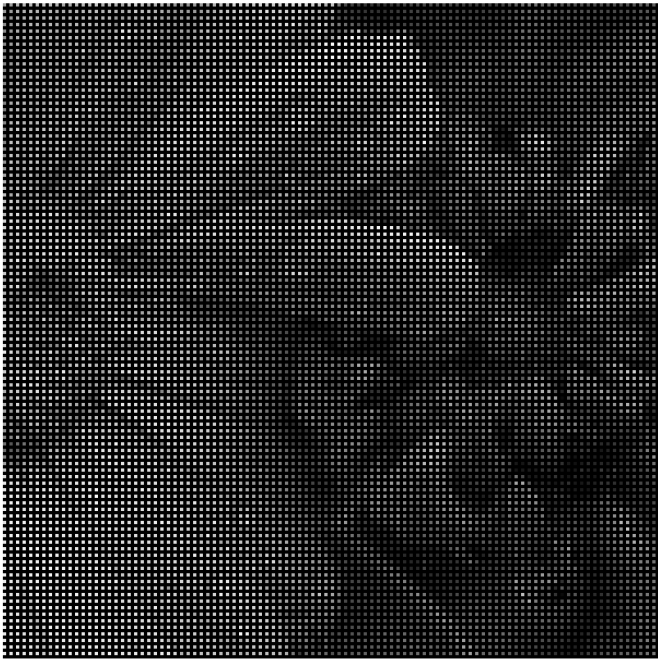


Dominio de la Frecuencia

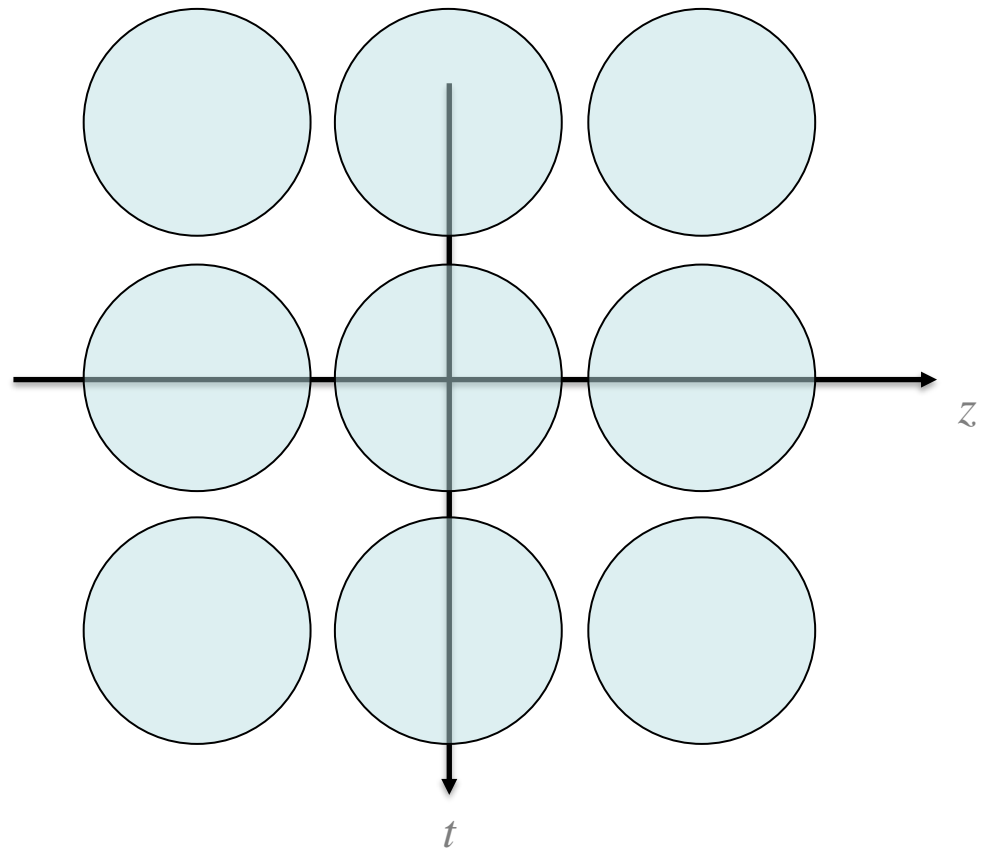


[Muestreo en 2D]

Dominio del Espacio

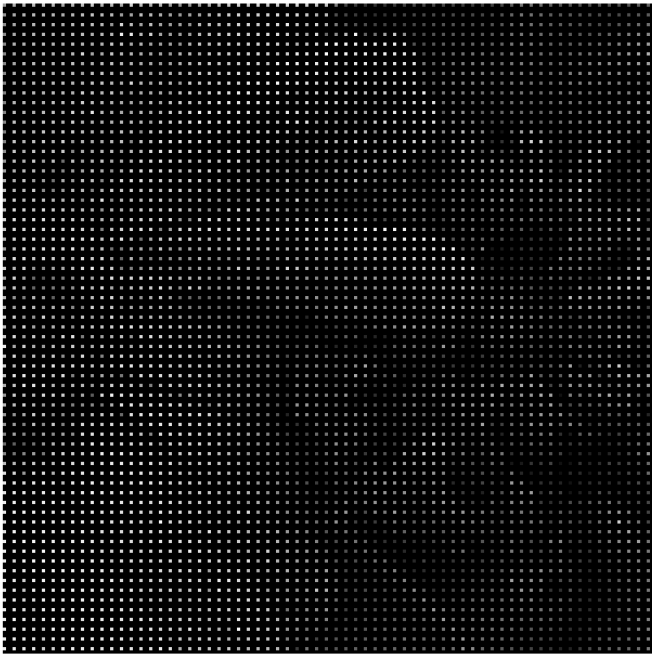


Dominio de la Frecuencia



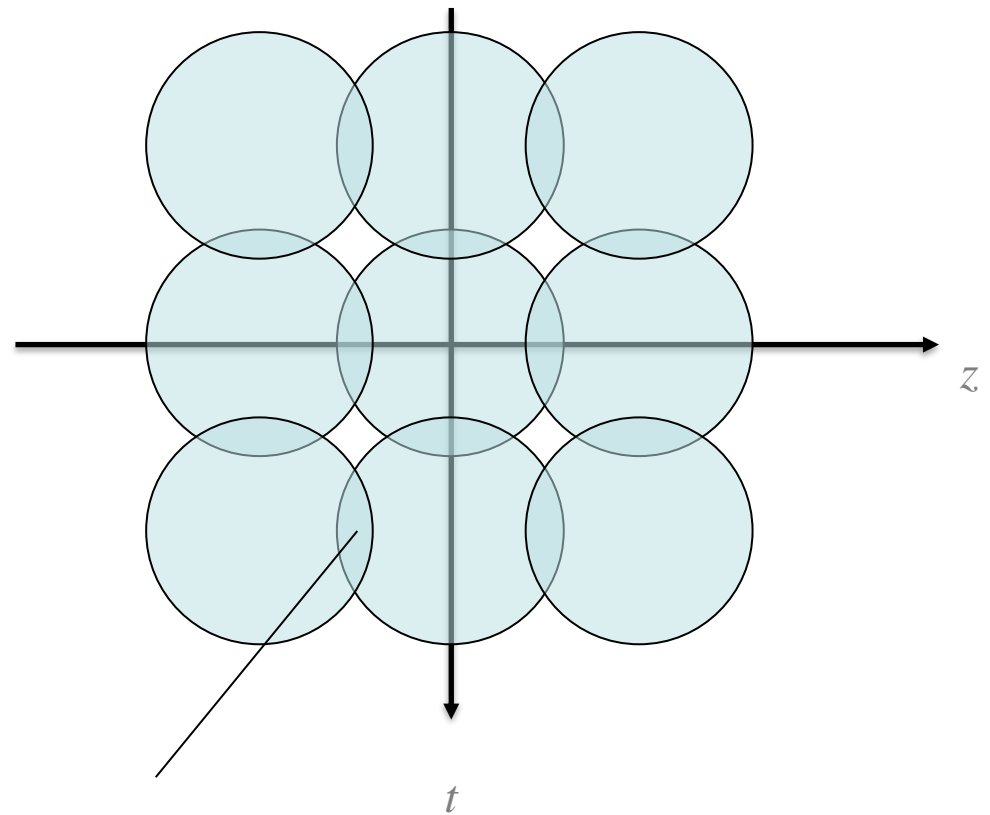
[Muestreo en 2D]

Dominio del Espacio



La frecuencia de muestreo debe ser al menos el doble de la frecuencia máxima de la imagen.

Dominio de la Frecuencia

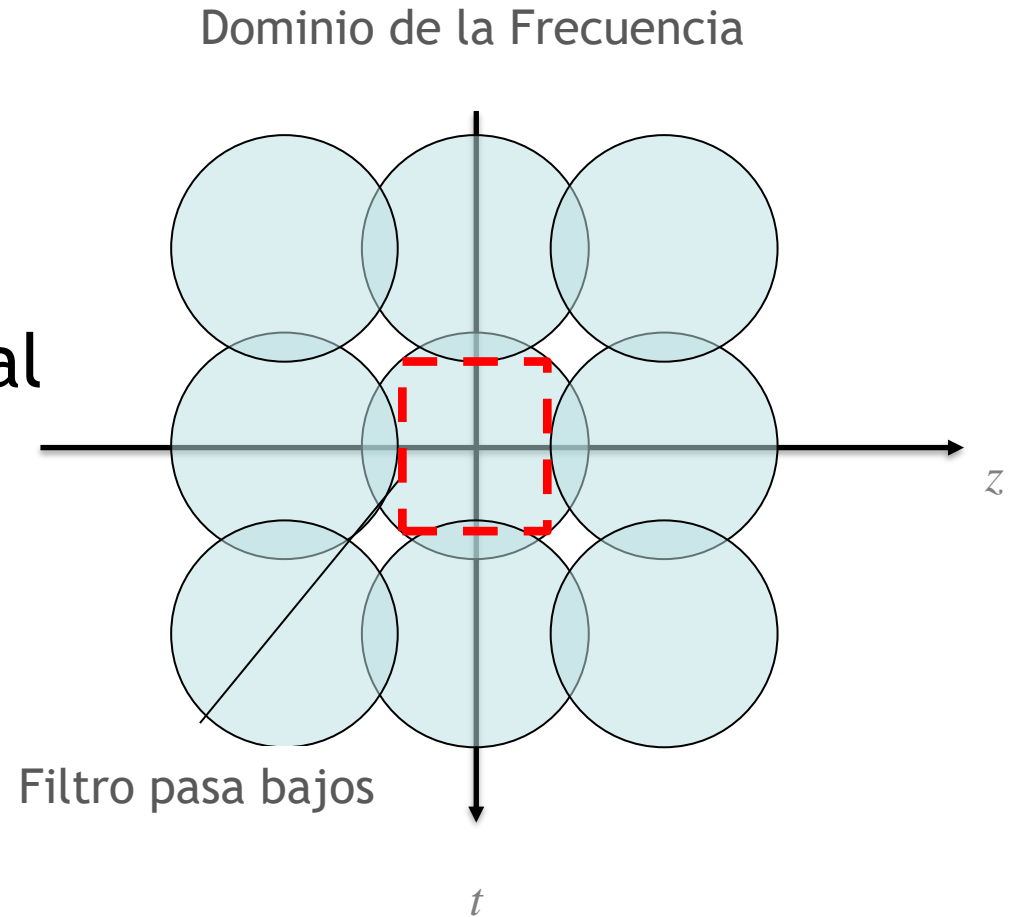


Traslape

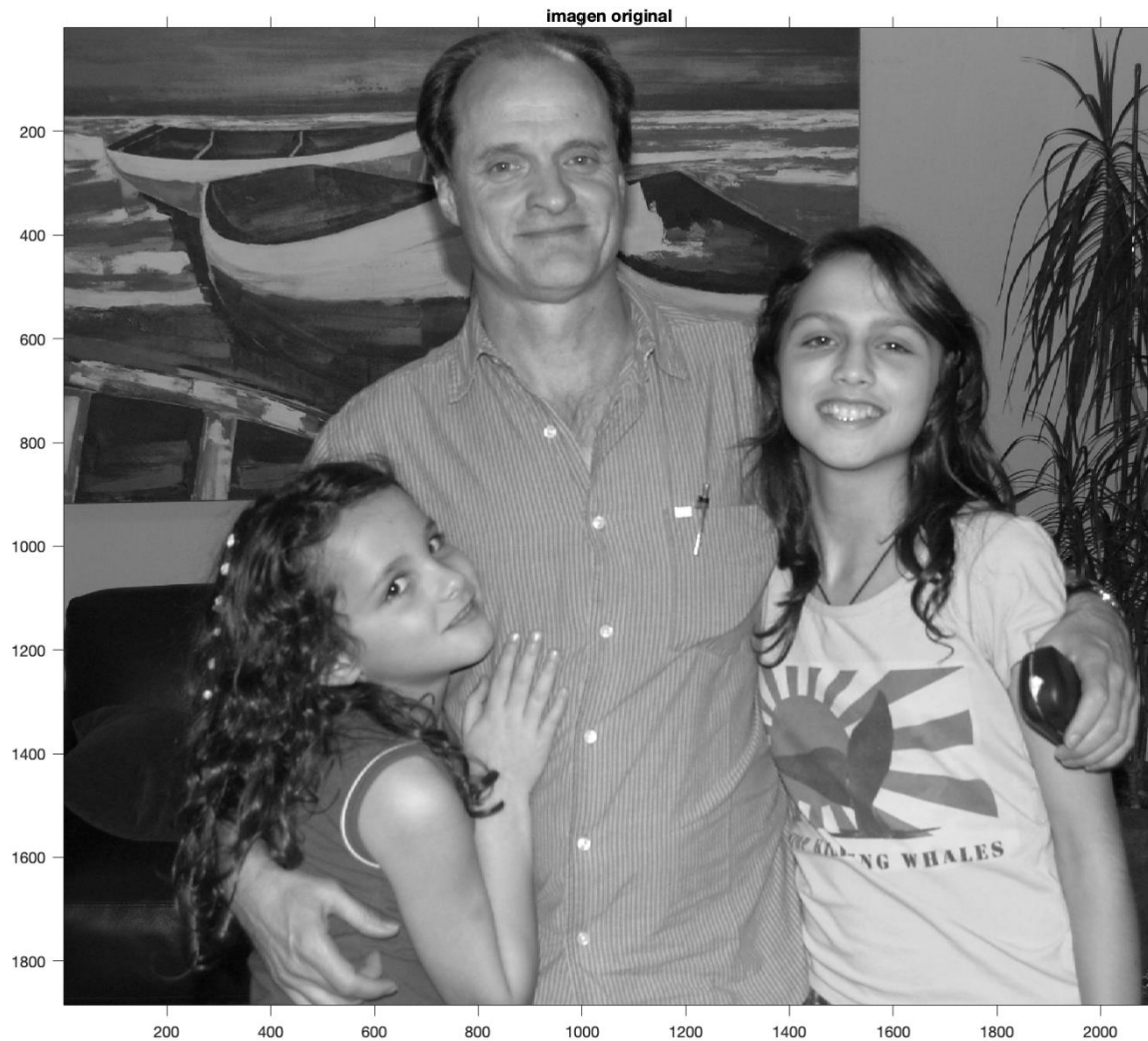
[Muestreo en 2D]

Cómo evitar traslape:

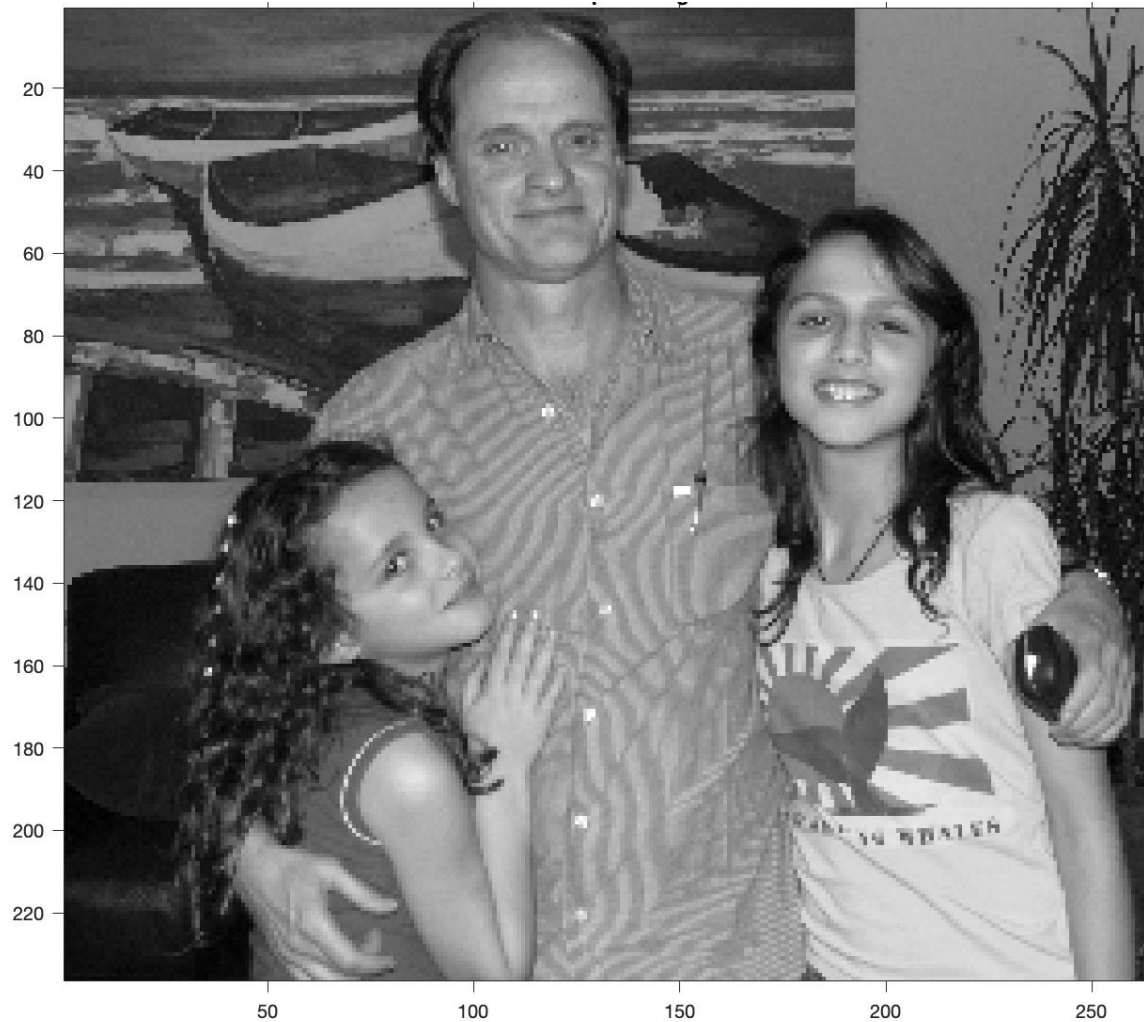
1. Tomar imagen original
2. Filtro pasa bajos
3. Muestreo



[Muestreo en 2D: Imagen original]



[Muestreo en 2D: Muestreo sin filtro pasabajos]



256 x 256

[Muestreo en 2D: Muestreo con filtro pasabajos]



256 x 256