Fourier transform

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There are various possible definitions for the Fourier transform. We shall use the definition presented in the reference [1], presented in (1).

$$S(\omega) = \int_{-\infty}^{\infty} dt\ s(t)e^{i\omega t} \tag{1a}$$

$$s(t) = \frac{1}{2\pi}\int_{-\infty}^{\infty} d\omega\ S(\omega)e^{-i\omega t}. \tag{1b}$$

We can also define the n-dimensional definition, presented in (2).

$$S(\omega) = \int_{\mathbb{R}^n} dt\ s(t)e^{i\omega t} \tag{2a}$$

$$s(t) = \left(\frac{1}{2\pi}\right)^n \int_{\mathbb{R}^n} d\omega\ S(\omega)e^{-i\omega t} \tag{2b}$$

It may also prove useful to define the the equivalent discrete Fourier transform (3), for a N point function.

$$S(\omega_m) = \sum_{n=0}^{N-1} s(t_n)e^{i\omega_m t_n} \tag{3a}$$

$$s(t_n) = \frac{1}{N}\sum_{m=0}^{N-1} S(\omega_m)e^{-i\omega_m t_n} \tag{3b}$$

References

[1] Govind P Agrawal. Fiber-optic communication systems. *NASA STI/Recon Technical Report A*, 93:17972, 1992.