Appendix D

Elements of Fourier Analysis

Periodic signals of period T:

$$s(t) = s_{av} + \sum_{k=1}^{\infty} S_k \cos(\omega_k t - \phi_k); \;\; \omega_k = 2\pi k/T$$

$$s_{av} = \frac{1}{T}\int_0^T s(t)\, dt; \;\; S_k = \sqrt{A_k^2 + B_k^2}; \;\; \phi_k = \arctan\left(B_k/A_k\right)$$

$$A_k = \frac{2}{T}\int_0^T s(t)\cos(\omega_k t)\; dt; \;\; B_k = \frac{2}{T}\int_0^T s(t)\sin(\omega_k t)\; dt$$

Non-periodic signals:

$$s(t) = \int_0^{\infty} S(\omega)\cos\left(\omega t - \phi(\omega)\right) d\omega$$

$$S(\omega) = \sqrt{A^2(\omega) + B^2(\omega)}; \;\; \phi(\omega) = \arctan\left(B(\omega)/A(\omega)\right)$$

$$A(\omega) = \frac{1}{\pi}\int_{-\infty}^{\infty} s(t)\cos(\omega t)\; dt; \;\; B(\omega) = \frac{1}{\pi}\int_{-\infty}^{\infty} s(t)\sin(\omega t)\; dt$$

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