ELEC 241: CA Session 8 Notes
Quiz II Review

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Fourier Series

$$s(t) = \sum_{k=-\infty}^{\infty} c_k e^{j2\pi \frac{k}{T} t}$$

$$c_k = \frac{1}{T} \int_0^T s(t) e^{-j2\pi \frac{k}{T} t} dt$$

For $s(t)$ real, $c_k = c_{-k}^*$

$$\text{Parseval}: \frac{1}{T} \int_0^T s^2(t) dt = \sum_{k=-\infty}^{\infty} |c_k|^2$$

Fourier Transform

$$\mathcal{F}[s(t)] = S(f) = \int_{-\infty}^{\infty} s(t) e^{-j2\pi ft} dt$$

$$s(t) = \int_{-\infty}^{\infty} S(f) e^{+j2\pi ft} dt$$

$$\text{Parseval}: \int_{-\infty}^{\infty} |s(t)|^2 dt = \int_{-\infty}^{\infty} |S(f)|^2 df$$

$$\text{Linearity}: \mathcal{F}\left[\sum_k \epsilon_k s_k(t)\right] = \sum_k \epsilon_k \mathcal{F}[s_k(t)]$$

$$x(t) \to y(t) \iff Y(f) = X(f) H(f)$$

Special Spectra

$$u(t) \longleftrightarrow \frac{1}{j2\pi f}$$

$$e^{-at} u(t) \longleftrightarrow \frac{1}{j2\pi f + a}$$

$$s(t) \cos(2\pi f_0 t) \longleftrightarrow \frac{1}{2}\left[S(f - f_0) + S(f + f_0)\right]$$

$$s(t) \sin(2\pi f_0 t) \longleftrightarrow \frac{1}{2}\left[S(f - f_0) - S(f + f_0)\right]$$

$$s(t - \Delta) \longleftrightarrow S(f) e^{-j2\pi f \Delta}$$

$$\frac{ds}{dt}(t) \longleftrightarrow j2\pi f S(f)$$

$$\int s(t) dt \longleftrightarrow \frac{1}{j2\pi f} S(f)$$

$$t^n s(t) \longleftrightarrow \left(\frac{1}{-j2\pi} \frac{d}{df}\right)^n S(f)$$

Spectral Symmetries

$$s(t) \text{ real} \iff S(f) = S(-f)^*$$

$$s(t) \text{ even} \iff S(f) \text{ even}$$

$$s(t) \text{ odd} \iff S(f) \text{ odd}$$

Op-Amps

No current

$V_+ = V_-$ (virtual short)

Negative feedback

Can cascade