DSAA Home Work - 02

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August 2017

Question Set: Nyquist Theorem

- Given $x(t)$, a real valued signal and sampling rate $\Omega_s = 8000\pi \, rad/s$ determine for what values of Ω does $X(\Omega)$ vanish?
- Given $y(t)$ with Nyquist rate Ω_1 determine the Nyquist rates of the following signals:

$$y_1(t) = y(t) + y(t - 1) \tag{1}$$

$$y_2(t) = \frac{d}{dt}x(t) \tag{2}$$

$$y_3(t) = y(t)exp(j\Omega_0 t) \tag{3}$$

- Given two signals $x_1(t)$ and $x_2(t)$ with corresponding maximum frequencies Ω_1 and Ω_2 respectively. Determine the Nyquist rate for the product using matlab for some example signals.

$$z(t) = x_1(t)x_2(t) \tag{4}$$

Hint: Choose $x_1(t) = cos(\Omega_1 t)$ and $x_2(t) = cos(\Omega_2 t)$, find the product and apply the fourier transform. The spectral locations should give the maximum frequencies.

Instructions for the report

Merge all the sections into a single pdf file and upload.

- Section 1: Please solve the theory part and scan the analysis to a pdf (Grade: 2 points)
- Section 2: Matlab code and results for the last problem. (Grade: 3 points)
- Section 3: Discussion (Grade: 5 points)