Project 5

IIR Filter Design

We wish to design a (notch) filter to remove $f_0 = 50Hz$ power-line interference from a signal as given in project 4. Assume the sampling frequency to be $f_s = 300Hz$. The order of IIR filter is 2. If Q denotes the Q-factor of the notch filter and the notch bandwidth is given by $\Delta f = f_0/Q$, design the notch filter for various values of Q (i.e, $Q = 5, 10, 20, 50, 100$) and compare their frequency responses.

Generate the power-line affected signal as

$$y(n) = x(n) + a\cos(2\pi f_0 n/f_s),$$

obtain the filtered output for various Q-factor choices.

Now consider the fact that the numerical precision of your hardware is limited, obtain the results if it has following precisions in the mentissa.

1. 3 places after decimal point.
2. 2 places after decimal point.
3. 1 place after decimal point.

(Note : For simplicity we use a decimal system of representation of number instead of a binary system).