

Due by 5 PM on Tuesday 5/1/07

Consider the following continuous time system

$$H(s) = \frac{100}{s^2 + 4s + 100}.$$

In this problem, you will feed discrete time signals to this system through a sample and hold to identify its frequency response.

1. Do a discretization of H using `c2d` using the `zoh` option, and a sampling period of 0.05 s. Generate a zero mean white random noise signal using `randn` and use it as an input to the discretized system using `lsim`. Take the resulting output over 10000 and 100000 time samples and name them as y_1 and y_2 respectively. Name the corresponding parts of the input u_1 and u_2 respectively.
2. Consider two cases for both y_1 and y_2 (four cases in total). The first is where u_i and y_i are used to identify the frequency response. The second is where the u_i and $y_i + n$ are used, where n is additive white gaussian noise of variance 1 (this can be generated using `randn`). In all four cases, identify the frequency response using `etfe`. Generate four bode plots each having one of the identified responses together with the original frequency response of H . Comment on the mismatches and possible sources thereof.
3. This part should be done with input and output signals of length 100000 time steps. The output should have additive noise of variance of 1. Instead of using white noise as input, use as input a colored noise signal \hat{u} . This signal is generated from a white noise signal u by passing it through a first order highpass filter with cutoff frequency of 8 rad/s. Plot the identified frequency response together with the real response and comment on the mismatches and sources thereof.