Part I. Paper Assignment

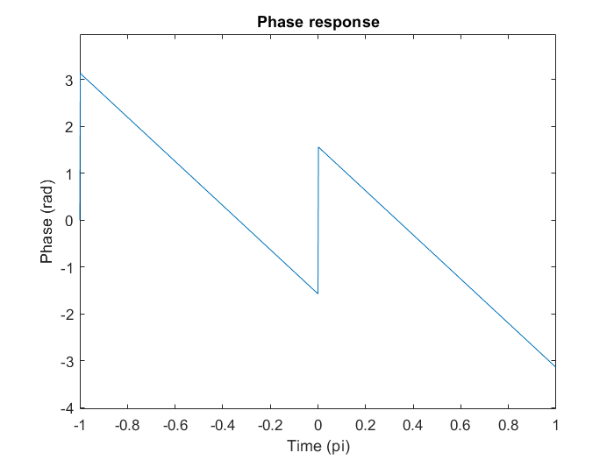
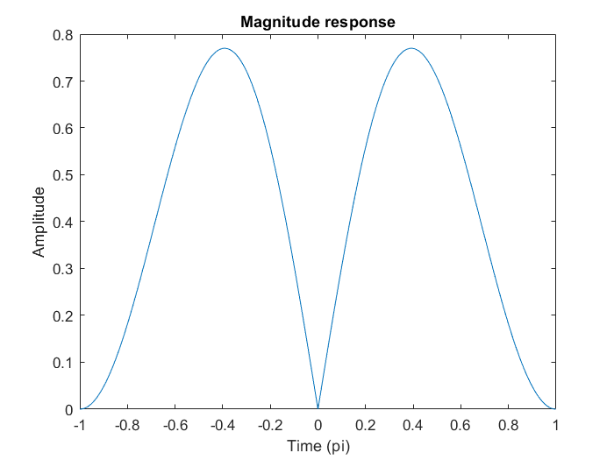
1. Determine the system function, magnitude response, and phase response of the following systems and use the pole-zero pattern to explain the shape of their magnitude response:

System function:

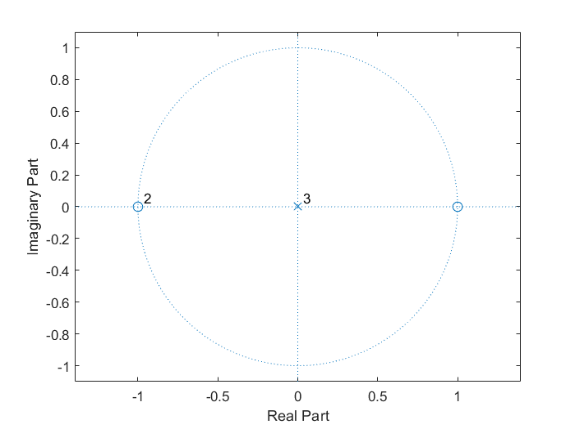
* Zero: 1, -1; Pole: 0

* Magnitude response:

* Phase response:



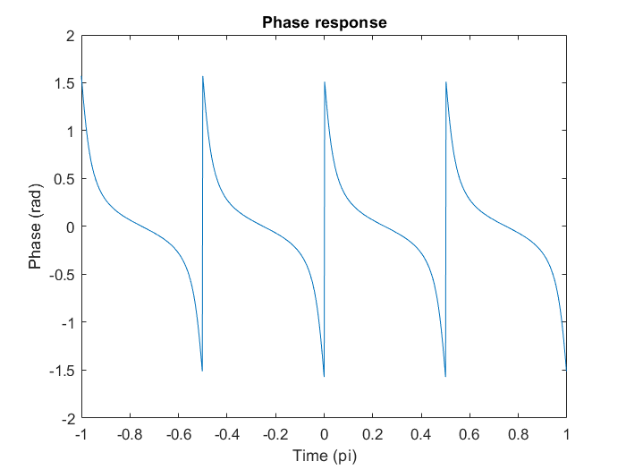
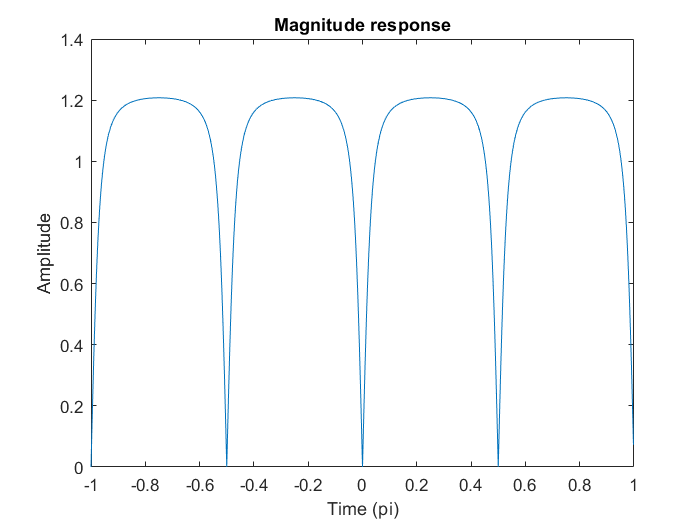
* Pole-zero pattern:



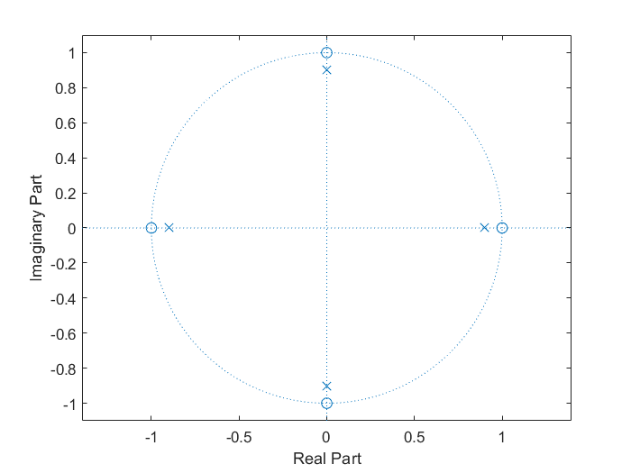
由pole-zero pattern我們可以推測magnitude response在處會是0，因為zero的緣故。

System function: 🡺 Zero: 1,j; Pole: 0.9,0.9j

Magnitude response: ； Phase response:



Pole-zero pattern:



由pole-zero pattern我們可以推測magnitude response在處會是0，因為zero的緣故。再加上在zero附近皆存在一個pole，因此magnitude response的rising time和falling time會比1(a)來的小。

1. Consider a periodic signal

.

For each of the following systems, determine if the system imparts (i) no distortion, (ii) magnitude distortion, and/or (iii) phase (or delay) distortion.

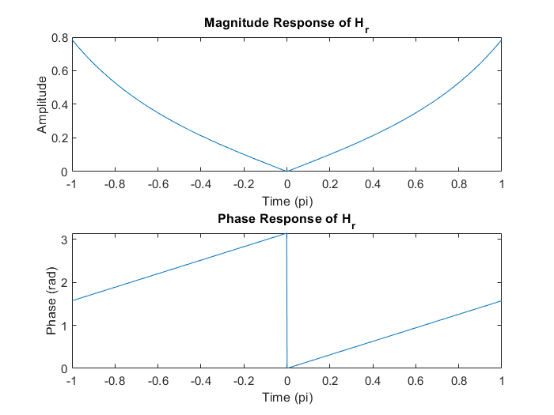
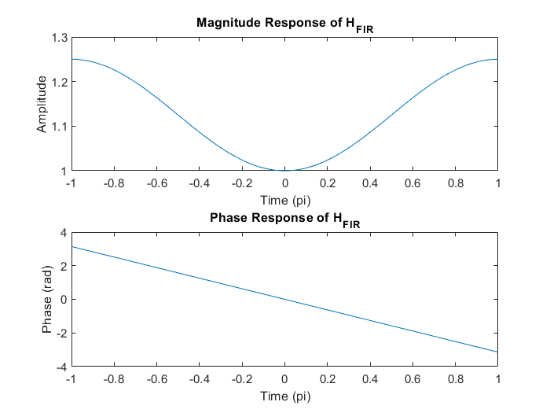
This system not only imparts magnitude but also phase distortion.

This system imparts no distortion.

1. An economical way to compensate for the droop distortion in S/H DAC is to use an appropriate digital compensation filter prior to DAC.
2. Determine the frequency response of such an ideal digital filterthat will perform an equivalent filtering given by following

1. One low-order FIR filter suggested in Jackson (1996) is

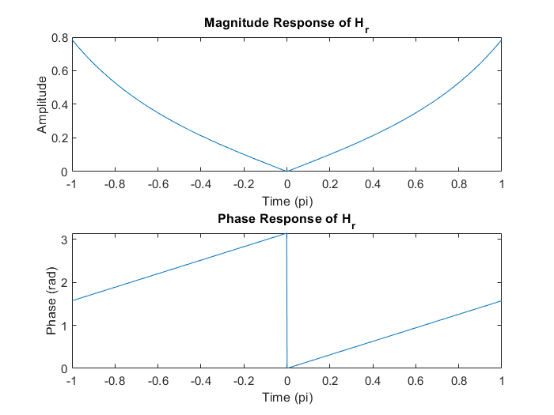
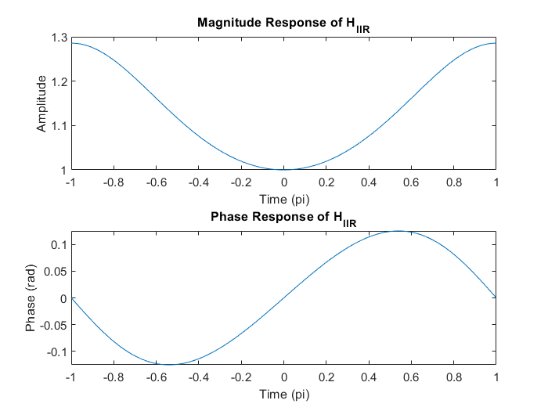
Compare the magnitude response ofwith that ofabove.



We can the curve of magnitude response ofis smoother and larger than magnitude response of.

1. Another low-order IIR filter suggested in Jackson (1996) is

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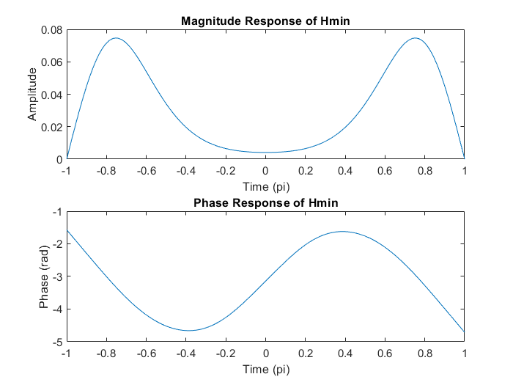
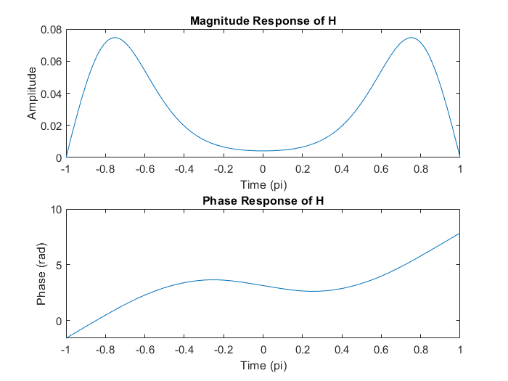
1. Consider the following continuous-time system
2. Show that the systemis a nonminimum phase system.

Minimum phase system: All poles and zeros are inside unit circle.

* Zeros: -1, 3, 2j & Poles: -5, -33j, -22j
* Only one zero is inside unit circle, so this is a nonminimum phase system.

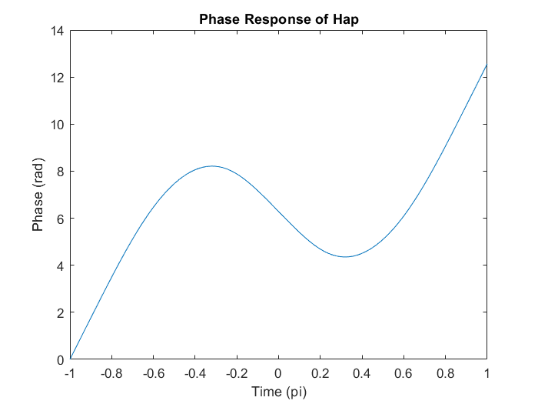
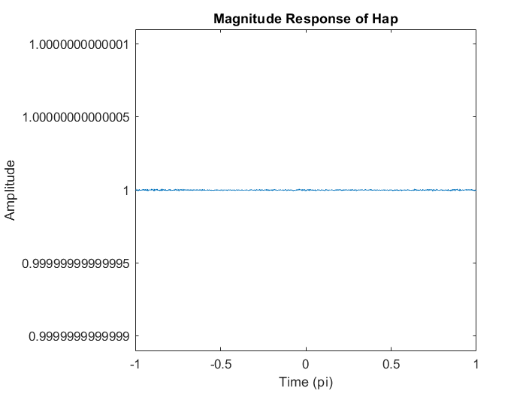
1. Decomposeinto the product of minimum phase component and an all pass component.

1. Briefly plot the magnitude and phase responses ofandand explain your plots.



We can find that and

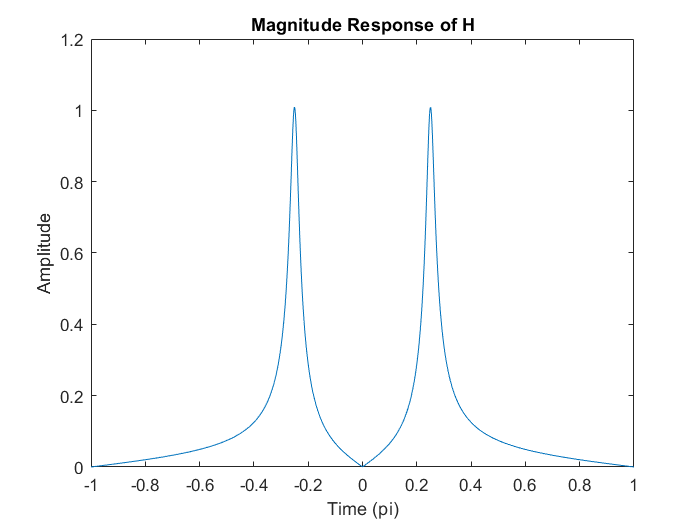
1. Briefly plot the magnitude and phase responses of.

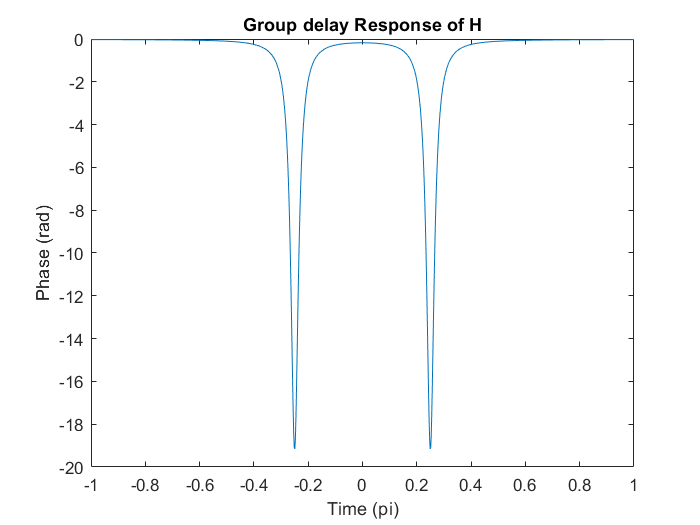
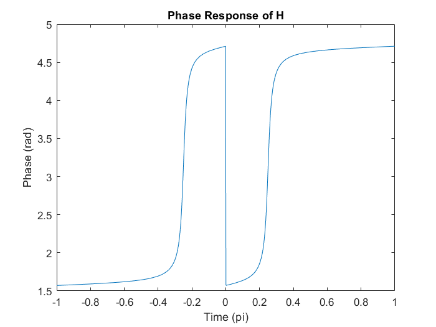


We can find that and

1. We want to design a second order IIR filter using pole-zero placement that satisfies the following requirements: (1) the magnitude response is 0 at and(2) The maximum magnitude is 1 atand (3) the magnitude response is approximatelyat frequencies. Determine locations of two poles and two zeros of the required filter and then compute its system function H(z).

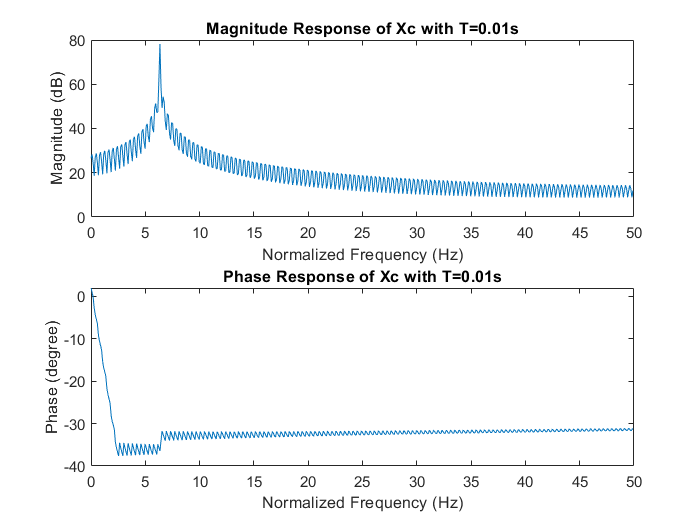
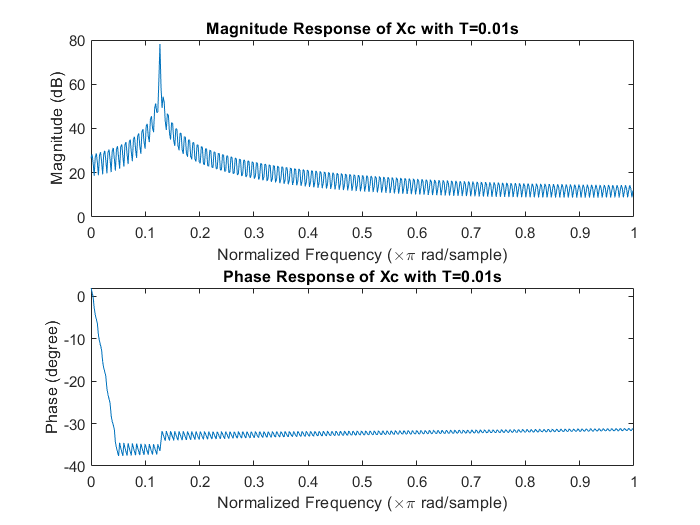
Zero: 1; Pole: 0.740.74j

1. Briefly graph the magnitude response of the filter. 
2. Briefly graph phase and group-delay responses.

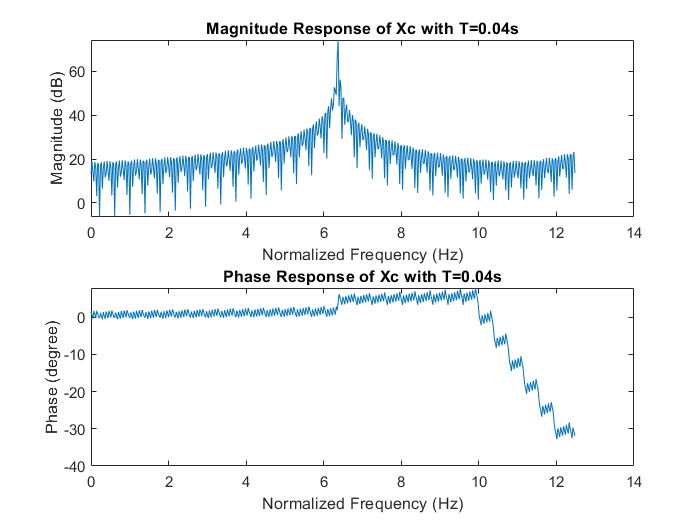
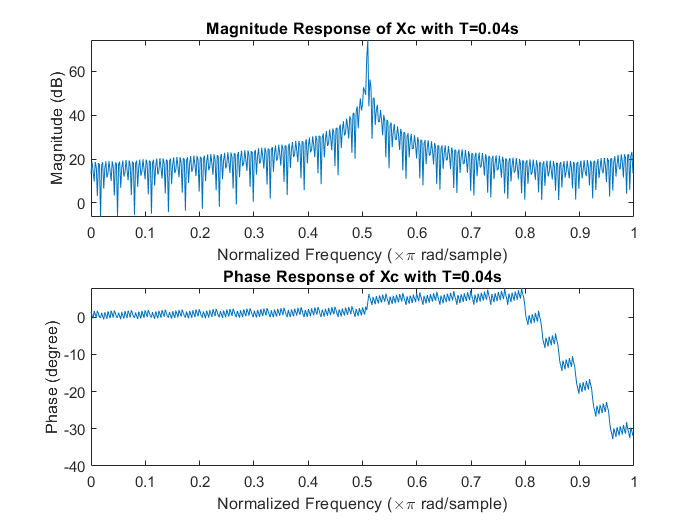


1. The following signalsis sampled periodically to obtain the discrete-time signal. For each of the given sampling rates inHz or in T period, (i) determine the spectrumof; (ii) plot its magnitude and phase as a function of ω inand as a function of F in Hz; and (iii) explain whethercan be recovered from.
2. , with sampling period

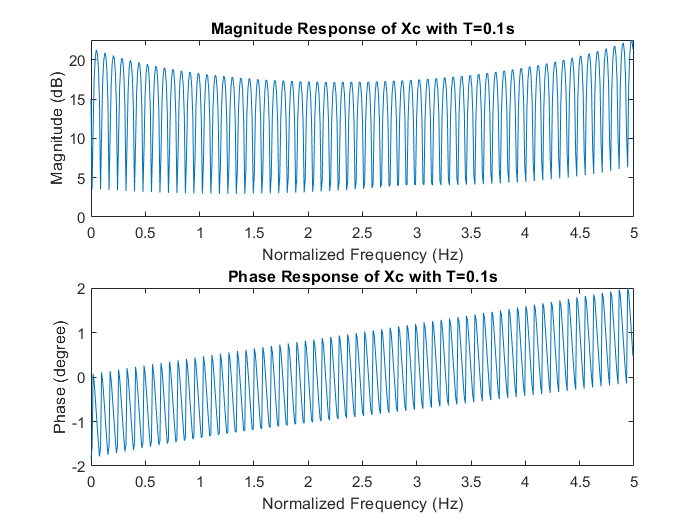
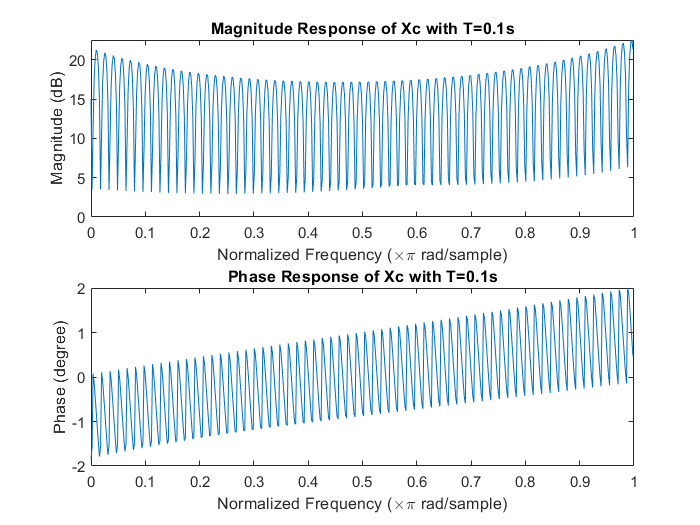
1. For T = 0.01s



1. For T = 0.04s



1. For T = 0.1s

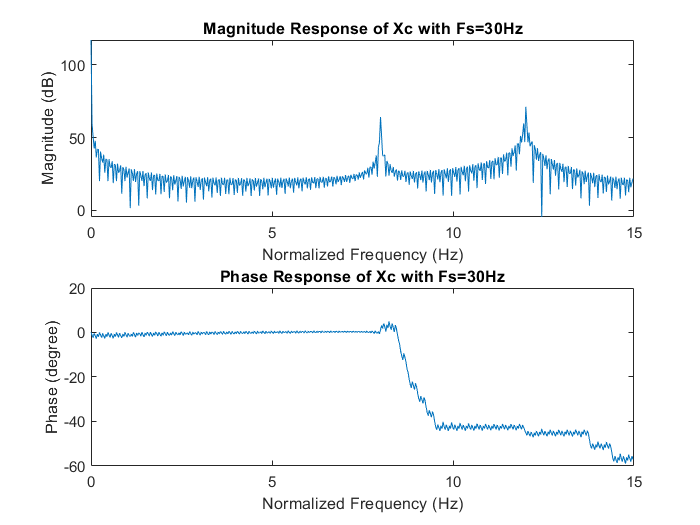
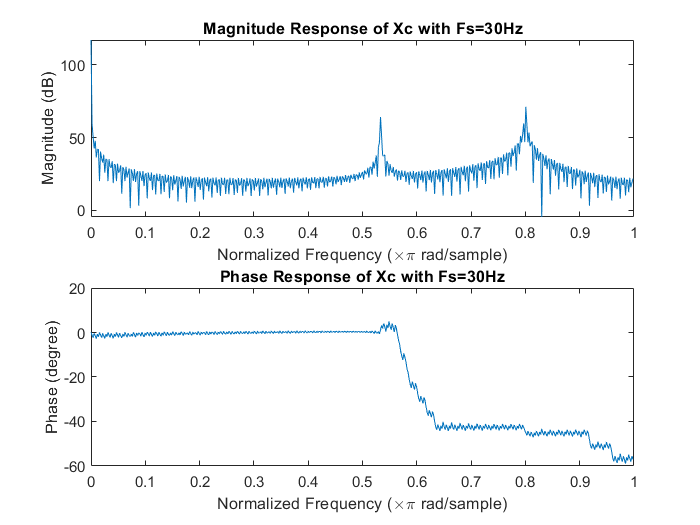


The sampling theorem shows that sampling signal can be recovered if , whichis/35 s, which equal to 0.089s, in the signal.

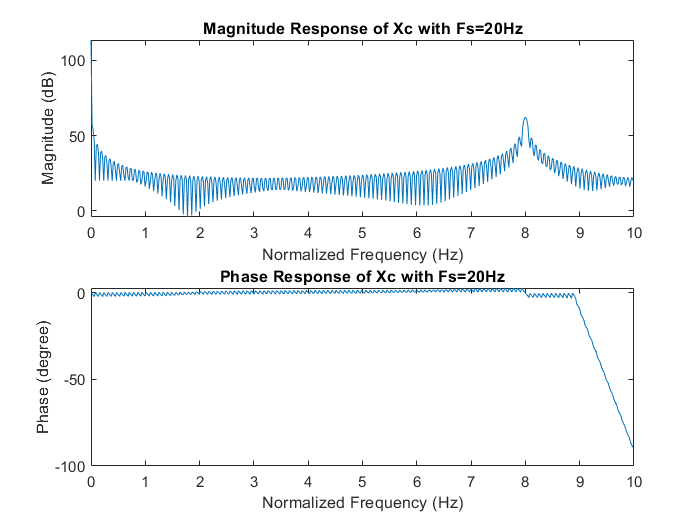
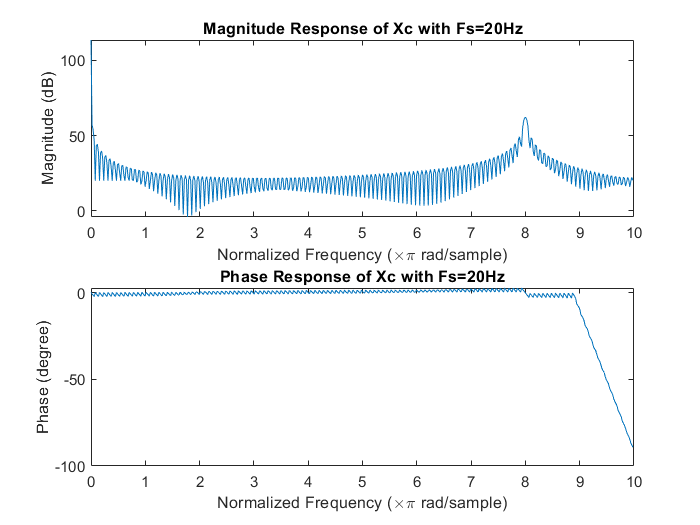
Therefore, the sampling signals withandcan be recovered.

1. , with sampling rate.

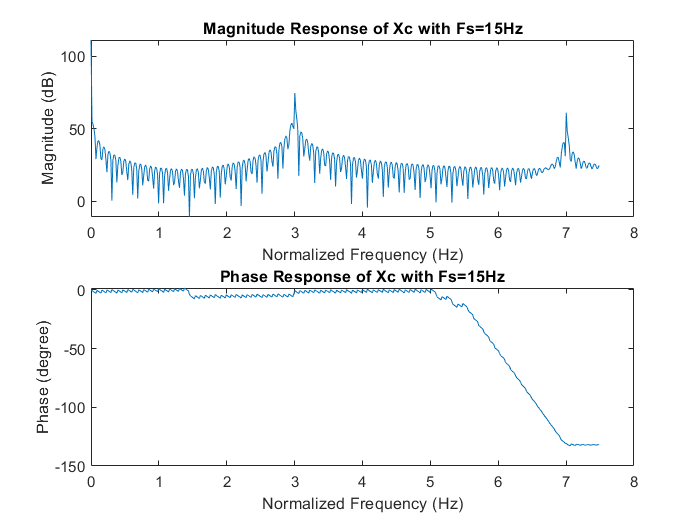
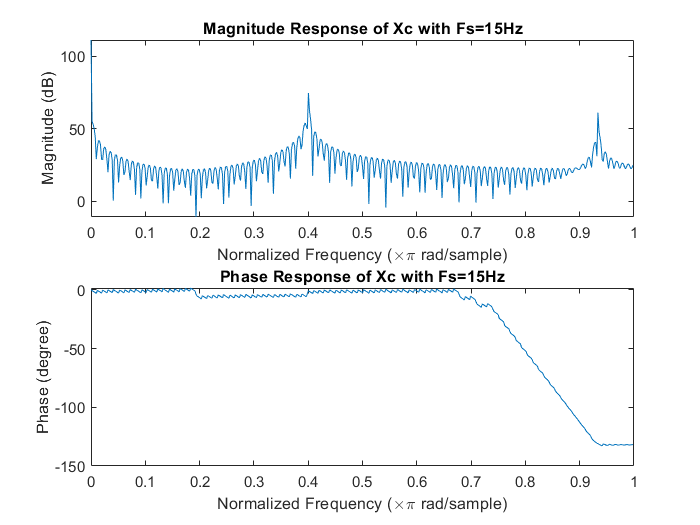
1. For



1. For



1. For



The sampling theorem shows that sampling signal can be recovered if , whichis 12Hz in the signal.

Therefore, only the sampling signal withcan be recovered.

1. An 8-bit ADC has an input analog range of ±5 volts. The analog input signal is

The converter supplies data to a computer at a rate of 2048 bits/s. The computer, without processing, supplies these data to an ideal DAC to form the reconstructed signal. Determine:

1. The quantizer resolution (or step).

= 8,

The quantizer step () isV.

1. The SQNR in dB.

1. The folding frequency and the Nyquist rate.
2. Folding frequency ( = 0.5 Sampling Frequency )

(2048 bits/s)/(8-bit/sample) = 256 samples/s

Sampling Rate = 256-bit/sampleFolding frequency = 128 Hz

1. Nyquist rate ( = )

Nyquist rate