Digital SignalProcessing/Processamento Digital de Sinais

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Tutorial Questions/Lista de Exercícios - 2

1. The continuous-time signal

was sampled with sampling period seconds to obtain a discrete-time signal .

1. What is the resulting discrete-time signal and the sampling frequency ?
2. Write a Matlab routine to plot sampled at 50 samples/second and at 500 samples/second.
3. Write a Matlab routine to show the sampled signal in the frequency domain.
4. Write a Matlab routine to reconstruct the signal from the samples obtained in item b). (Hint: use the sinc function)
5. Consider the system below with the discrete-time system being an ideal lowpass filter with cutoff frequency equal to radians/second.

A/D Converter

Discrete-Time System

D/A Converter

1. If is bandlimited to 5kHz, what is the maximum value of T that will avoid aliasing in the A/D converter?
2. If 1/T = 10 kHz, what will be the cutoff frequency of the effective continuous-time filter?
3. Consider the quantisation of a discrete-time signal with a resolution .

How many bits are required in the A/D converter?

1. When
2. When and .

What is the SQNR?

1. When and .
2. When and
3. Consider the system described by

A/D Converter

Discrete-Time System

D/A Converter

The input signal has the Fourier transform shown in the figure below with radians/second. The discrete-time system is an ideal lowpass filter with frequency response described by

and

1. What is the minimum sampling rate such that no aliasing occurs in sampling the input?
2. Sketch the spectrum of the sampled signal at .
3. If , what is the minimum sampling rate such that .