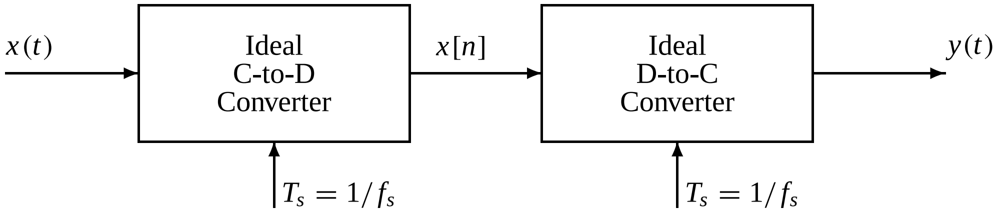
PROBLEM:



Suppose that the $\boxed{\text{output}}$ of the D-to-C converter in the system above is found to be

$$y(t) = 2 + 10\cos(2\pi(150)t + \pi/3)$$

when the sampling rate is $f_s = 1/T_s = 400$ samples/second.

(a) Give an equation for $x[n]$ in terms of cosine functions. **Write your answer on the line below.**

Answer: $x[n] =$ ______________________________

(b) Determine two *different* input signals $x(t) = x_1(t)$ and $x(t) = x_2(t)$ that could have produced the given output of the D-to-C converter. **All of the frequencies in your answers must be positive and less than 400 Hz. Write your answers for both inputs on the lines below.**

Answer: $x_1(t) =$ ______________________________

Answer: $x_2(t) =$ ______________________________

McClellan, Schafer and Yoder, *Signal Processing First*, ISBN 0-13-065562-7.
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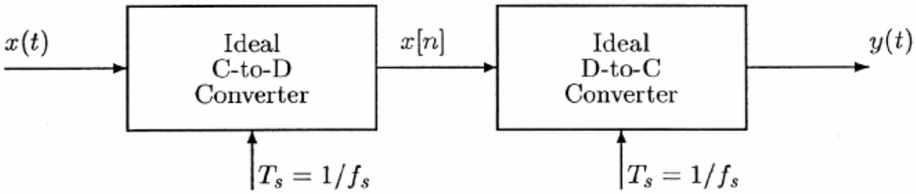
SOLUTION



Suppose that the $\boxed{\text{output}}$ of the D-to-C converter in the system above is found to be

$$y(t) = 2 + 10\cos(2\pi(150)t + \pi/3)$$

when the sampling rate is $f_s = 1/T_s = 400$ samples/second.

(a) Give an equation for $x[n]$ in terms of cosine functions. **Write your answer on the line below.**

With no aliasing, going through a D/C converter is the inverse of going through the C/D. Therefore, we can get x[n] by passing y(t) through a C/D converter.

Answer: $x[n] = 2 + 10\cos(2\pi(150)n/400 + \pi/3)$

$= 2 + 10\cos(3n\pi/4 + \pi/3)$

(b) Determine two *different* input signals $x(t) = x_1(t)$ and $x(t) = x_2(t)$ that could have produced the given output of the D-to-C converter. **All of the frequencies in your answers must be positive and less than 400 Hz. Write your answers for both inputs on the lines below.**

Answer: $x_1(t) = 2 + 10\cos(2\pi(150)t + \pi/3)$

(no aliasing)

Answer: $x_2(t) = 2 + 10\cos(2\pi(250)t - \pi/3)$

We have folding in the second case.

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