PROBLEM:

The “spectrum” diagram gives the frequency content of a signal.

(a) Draw a sketch of the spectrum of $x(t)$ which is “sine-times-cosine”

$$x(t) = \sin(500\pi t)\,\cos(700\pi t)$$

Label the frequencies and complex amplitudes of each component.

(b) Determine the minimum sampling rate that can be used to sample $x(t)$ without any aliasing.

McClellan, Schafer and Yoder, *Signal Processing First*, ISBN 0-13-065562-7.
Prentice Hall, Upper Saddle River, NJ 07458.

SOLUTION

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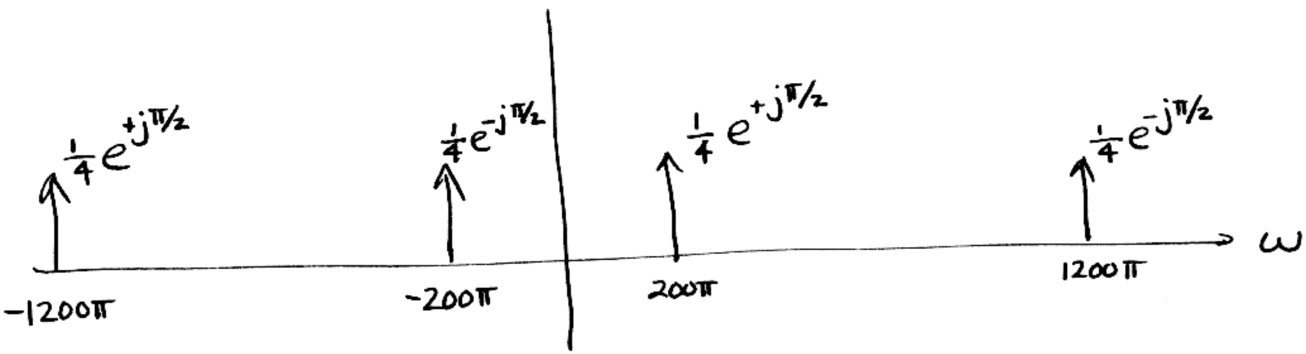
$$\left(\frac{e^{j500\pi t} - e^{-j500\pi t}}{2j}\right)\left(\frac{e^{j700\pi t} + e^{-j700\pi t}}{2}\right).$$

$$= \frac{1}{4} e^{-j\pi/2}\left(e^{j1200\pi t} - e^{j200\pi t} + e^{-j200\pi t} - e^{-j1200\pi t}\right).$$



(b) Determine the minimum sampling rate that can be used to sample $x(t)$ without any aliasing.

$$F_{SAMP} \geq 2 \times (\text{Highest\_Freq})$$

$$\therefore F_{SAMP} \geq 2 \times 600 \text{ Hz}$$

1200π rad/sec $= 2\pi(600)$

$$= 1200 \text{ Hz}$$

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