

The Sampling Theorem

Lesson 14

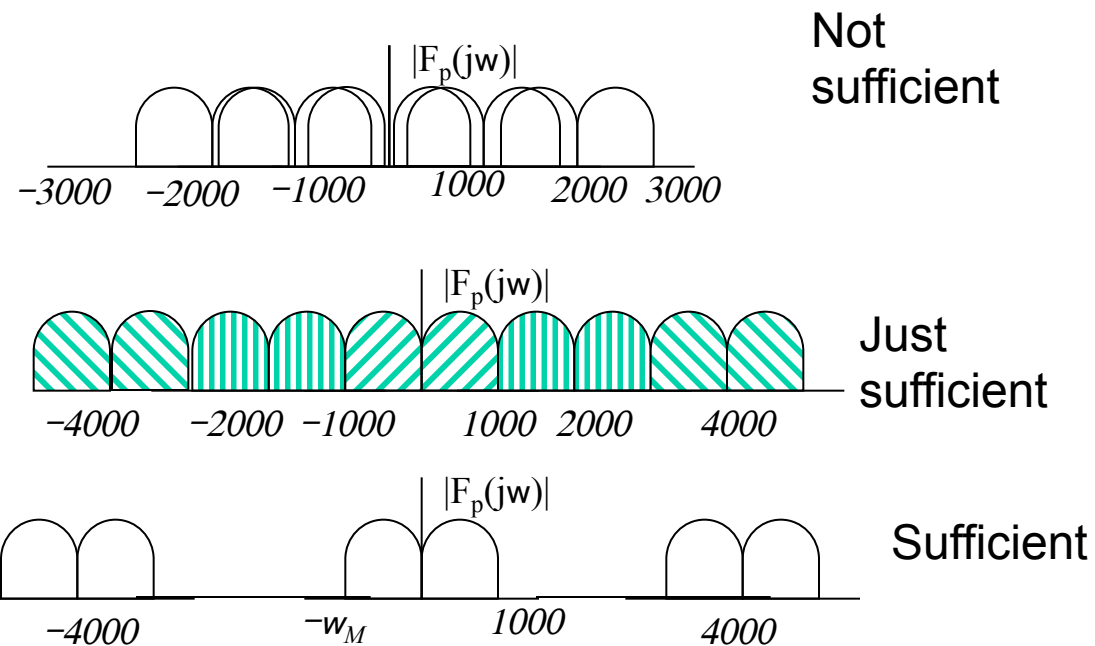
Sec 5.3.3

Homework

- Problem (1)
 - A BL signal with maximum frequency 1000 Hz is sampled at rate of 1000 samples per second, 2000 samples per second, and 4000 samples per second. Draw the sampled spectrum for each and describe whether the samples are sufficient to reconstruct the original signal
- Problem (2)
 - 20 BL signals (1000 Hz) are sampled at the Nyquist Rate. Calculate the pulse width of each sample to support the multiplex of these 20 signals. Calculate the pulse rate of the aggregate multiplex signal. Repeat for 200 signals.
- Problem (3)
 - Consider N signals, each BL (1 Hz). If a transmission system can handle 40 pulses per second, how many messages can be sent? Repeat for 100 pulses per second.

Homework Answers #1

- Problem (1)
 - A BL signal with maximum frequency 1000 Hz is sampled at rate of 1000 samples per second, 2000 samples per second, and 4000 samples per second. Draw the sampled spectrum for each and describe whether the samples are sufficient to reconstruct the original signal



Homework Answers #1

- Problem (2)
 - 20 BL signals (1000 Hz) are sampled at the Nyquist Rate. Calculate the pulse width of each sample to support the multiplex of these 20 signals. Calculate the pulse rate of the aggregate multiplex signal. Repeat for 200 signals.
 - Each signal is sampled at a rate of 2000 samples per second. Assuming 50% duty cycle, the pulse width of the samples is $1/2$ of the period $1/2000$ sec or 500 μ sec or 250 msec. However, there are 20 signals which must be sampled during this time. So the pulse rate of the sample is now 20×2000 samples per second or 40,000 samples/sec. This yields a pulse width of $1/2 \times 1/40000$ sec = 12.5 μ sec.
 - For 200 signals, the pulse width of sample is now 1.25 μ sec and the pulse rate is 400,000 samples per second.

Homework Answers #1

- Problem (3)
 - Consider N signals, each BL (1 Hz). If a transmission system can handle 40 pulses per second, how many messages can be sent? Repeat for 100 pulses per second.
 - A BL 1Hz signal must be sampled at 2 samples per second. Dividing this into 40 yields 20 signals for the 40 pulses per second channel and 50 signals for the 100 pulses per second channel