

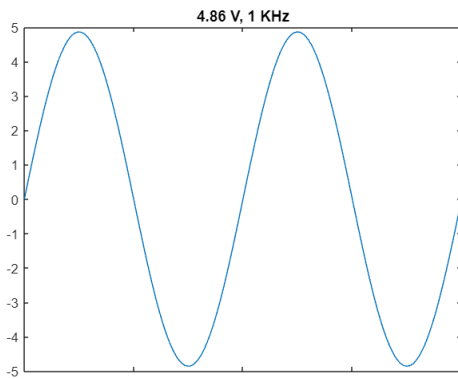


Communication Lab Report
Experiment Five
Sampling and Reconstruction

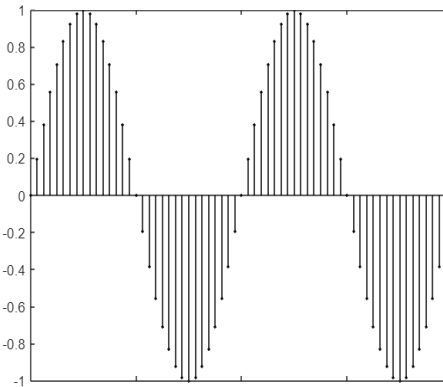
Mohammed Emad Yasseen
1733041

~ Step # (3 + 4)

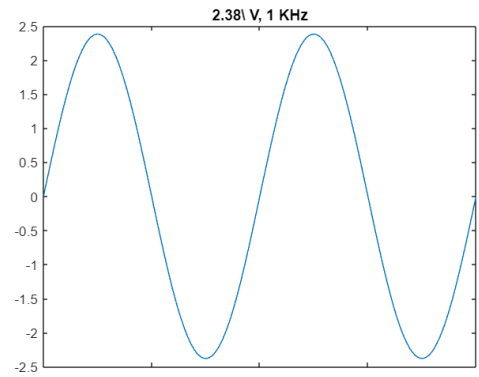
1 kHz sine wave (tp. 7)



SAMPLE OUTPUT (tp. 33)

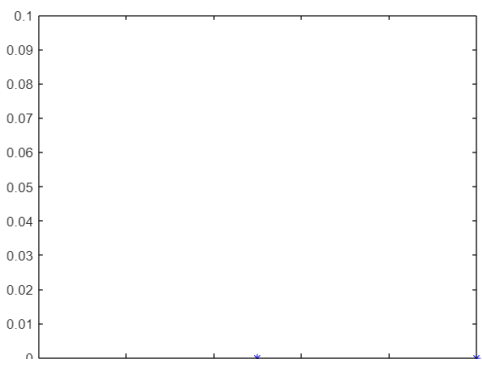


Output of the FOURTH ORDER
LOWPASS FILTER (tp. 49)

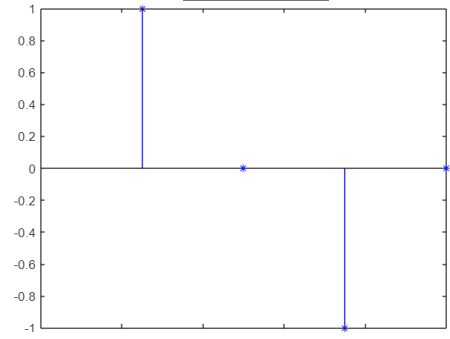


~ Step # 5: Change the sampling frequency to 2 kHz, 4 kHz, 8 kHz, 16 kHz and back to 32 kHz and draw the sampled signal at tp33.

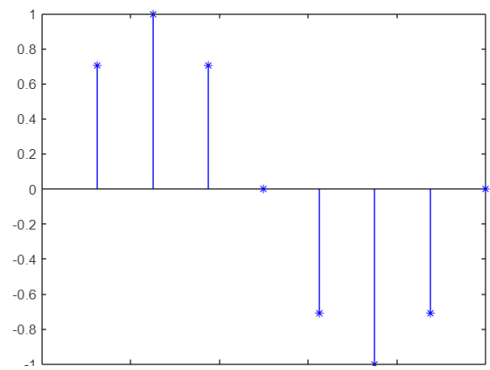
2 kHz



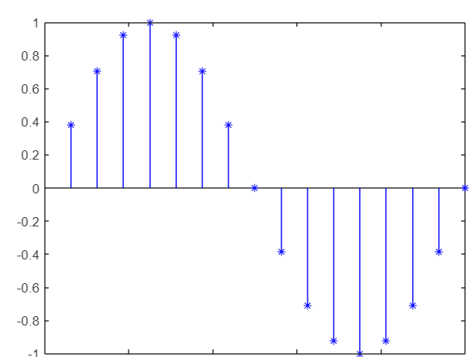
4 kHz

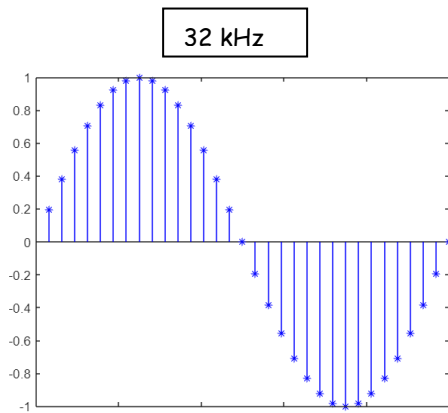


8 kHz



16 kHz





What is the Effect of Sampling Frequency on Natural Sampling and the Reconstructed Signal?

Increasing the samples improve the shape of the sampled signal. If the sampling rate is at or below the Nyquist frequency, increasing it will improve the reconstructed signal by eliminating aliasing distortion. But if it is already significantly above, no improvement is expected, all other factors being equal.

~ Step # 6 + 7:

What is the Effect of Duty Cycle on Natural Sampling and the Reconstructed Signal?

Less spaces between the pulses which improves the shape of the sampled signal. The amplitude of the reconstructed signal rolls off as frequency approaches the sample clock frequency.

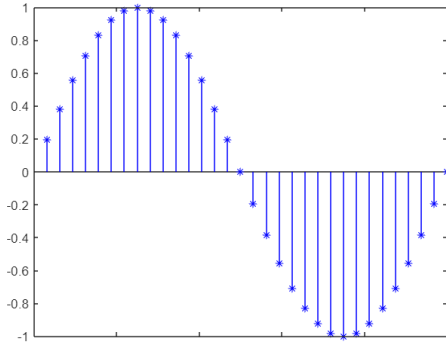
~ Step # 8 + 9:

Compare between Second-Order and Fourth-Order Low Pass Filters in Reconstructing the Signal after Natural Sampling.

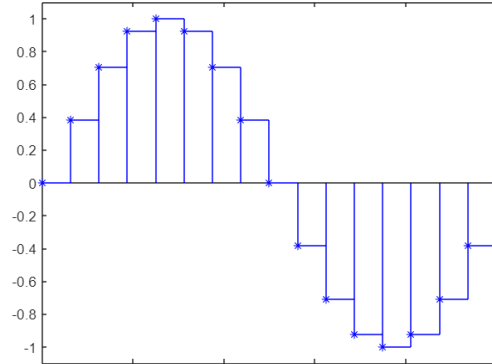
At high sampling frequencies they are pretty similar but when it comes more challenging with low sampling rate the fourth order LPF outperform the second order LPF by a large margin with better and smoother reconstructed signal.

~ Step # 10:

SAMPLE OUTPUT (tp. 33)



SAMPLE/HOLD OUTPUT (tp. 35)



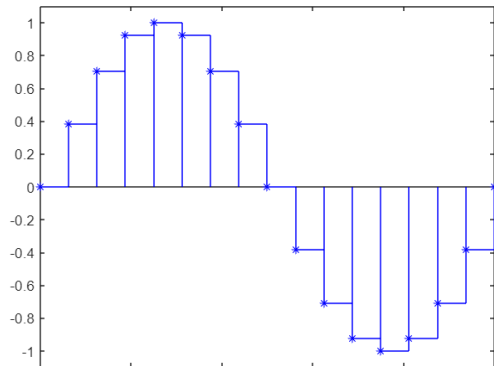
~ Step # 11:

What are the Effect of Sampling Frequency and Duty Cycle on Sample-Hold Process?

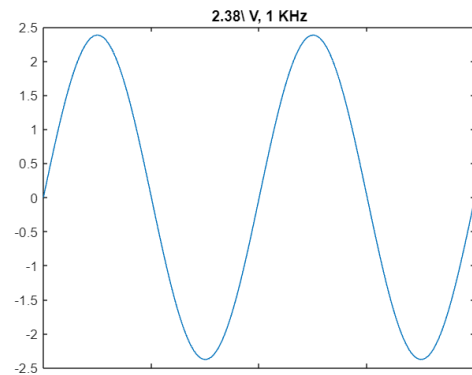
The same effects on natural sampling by improving the shape of the sampled signal and making it easier to be reconstructed.

~ Step # 12:

SAMPLE/HOLD OUTPUT (tp. 35)



Output of the FOURTH ORDER
LOWPASS FILTER (tp. 49)



~ Step # 13:

What is the Effect of Sampling Frequency on the Reconstructed Signal from Sample-Hold process?

Same effect on natural sampling, increasing it will improve the reconstructed signal by eliminating the aliasing disorder.

~ Step # 14:

What is the Effect of Duty Cycle on the Reconstructed Signal from Sample-Hold process?

No significant effect.

~ Step # 15:

Compare between Second-Order and Fourth-Order Low Pass Filters in Reconstructing the Signal after Sample-Hold process.

Again the fourth order LPF outperform the second LPF not by the same margin but it's still significant when it comes to low sampling rate the fourth order LPF has much cleaner less distorted output signal.

*in this experiment we worked with LPF with a cutoff frequency at 3.4 KHz to eliminate as much noise by not giving it a large bandwidth especially when working with audio signals which are under the 300 - 3300 Hz range so the LPF filters any signal out of this frequency range.