THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY
ISDN 2602

Laboratory 3: Frequency Analysis and Analog Modulation (5%)

Answer Sheet

Please write down your answer here and submit your answer on GitHub by Wednesday (Oct 15th) 23:59

Github classroom link:
https://classroom.github.com/a/LjghOE-Z

T ask 1: Modulation

In this task, you will learn how to modulate a carrier wave by a message signal.

C heck Point:

1) From the second figure, we can observe how modulation changes the spectrum of the signal. Revise the code so that the center of the signal spectrum will be moved to 10kHz.

   (Commit the revised codes to GitHub. Show your results to TAs.

2) Revise the cut-off frequency of the low pass filter to 3 KHz. Describe how the modulated signal changes due to the cut-off frequency revision. What is the advantage of using a smaller cut-off frequency? What is the cost?

The advantage is that you can have more senders in a given range of frequencies because the bandwidth of each channel is smaller, the cost is that higher frequency components will be Attenuated

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Fill in the answers, commit the revised codes to GitHub
and show your result to the TA.

Task 2 – Demodulation

In this task, you will learn how to demodulate the received signal.

C heck point:

1) There are three copies of the amplitude spectrum in the third subplot of Figure 1. Do they have the same amplitude? Explain why.

No they do not have the same amplitude, because when you demodulate the signal you multiply the received signal with a cos wave that has the carrier frequency and that leads to cos*cos and due to trig identity we get half the amplitude

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2) Revise the demodulation carrier frequency to "1.001.*freq_carrier" in arguments of the demodulate function. Can you notice the change in the time domain signal? Briefly explain why. How about changing the demodulation frequency to 1.1*freq_carrier?

Yes there is change in the time domain, the recovered signal is less accurate this is because the demodulate signals frequency is not matching the carrier frequency this results in frequency mismatch causing distortion on top of the signal

Fill in the answers to the blanks and Show your result to the TA.

T ask 3 – Estimate carrier frequency

In this task, you will estimate the values of the carrier frequency and the cutoff frequency of the low pass filter from the spectrum of the original and modulated signals.

C heck point:

1) Determine the carrier and cut-off frequencies. Show your solution codes to the TA for checking.

(Commit the revised codes to GitHub. Show your results to TAs.)

Fill in the answers to the blanks. Commit the revised codes to GitHub and Show your result to the TA.

T ask 4 – Frequency Division Multiplexing

In this task, we will share a communication channel among three users using frequency division multiplexing. Different users will be assigned to different frequency bands.

C heck point:

1) Determine the carrier frequencies for three users and show your results to the TA for checking.

(Commit the revised codes to GitHub. Show your results to TAs.)

Fill in the answers to the blanks. Commit the revised codes to GitHub and Show your result to the TA.

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