NATIONAL CHIAO-TUNG UNIVERSITY

Introduction to Communications System: Software Term Project

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I. PROJECT NOTES

1. The project is due at **midnight** on **December 8, 2016**.
2. **Duplication** from others' projects will receive **zero points** in this term project.
3. For any questions about this project, you are welcome to contact or visit TAs before the due date. Note that if you wish to send your questions to TAs through emails, please send your questions to both TAs.

II. SYSTEM MODEL

1. In this project, the system model in Slide "Chapter 2-2" is assumed.
2. A message $m(t)$ will be modulated and up-coverted to generate the modulated wave $s(t)$. The channel is noise-free, and hence the channel output received by the demodulator will be exactly $s(t)$. Instead of giving students the continuous waveform of $s(t)$, students will receive a sampled version of it, i.e.,

   $$s[n] = s(nT),$$

   where $n = 0, 1, 2, \ldots$, and T is the sampling period. Students can of course plot $s[n]$ to recover the waveform of $s(t)$.
3. Students shall down-convert and demodulate $s[n]$ and submit the estimate of message signal, $\hat{m}[n]$.

4. What shall be submitted includes the following three items.

   (a) Five demodulation outputs (i.e., $\hat{m}[n]$), each in a separate file, should be submitted via **ftp**-ing to the respective server. Files should be named as

   "student ID"+"Original file name of $s[n]$"

   (b) Demodulator programs with comments must also be submitted. Files should be named as

   "student ID"+"code"

   (c) A written report, remarking on the demodulator program and the demodulation results (i.e., $\hat{m}[n]$) should be submitted. The demodulation outputs should be plotted in the report. It is suggested that the report should be made less than 10 pages, including the five plots.

III. Samples of $m(t)$

Message signal $m(t)$ is formed by a sequence of 0-waveforms and 1-waveforms, which are respectively depicted in Figures 1 and 2. For example, $m(t)$ corresponding to bits [0110] will be the curve shown in Figure 3.

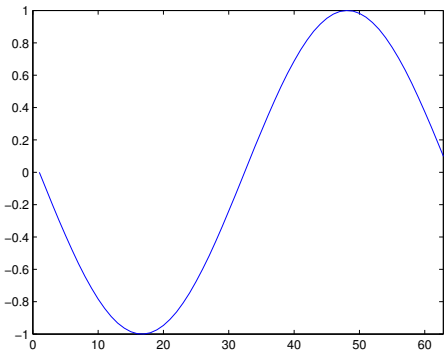

Figure 1: The 0-waveform

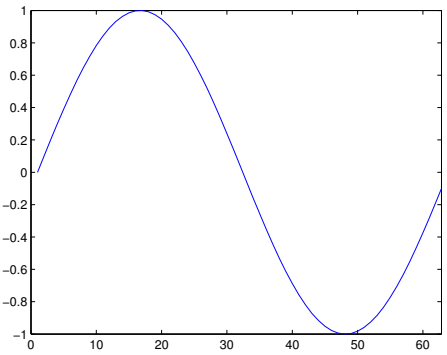

Figure 2: The 1-waveform

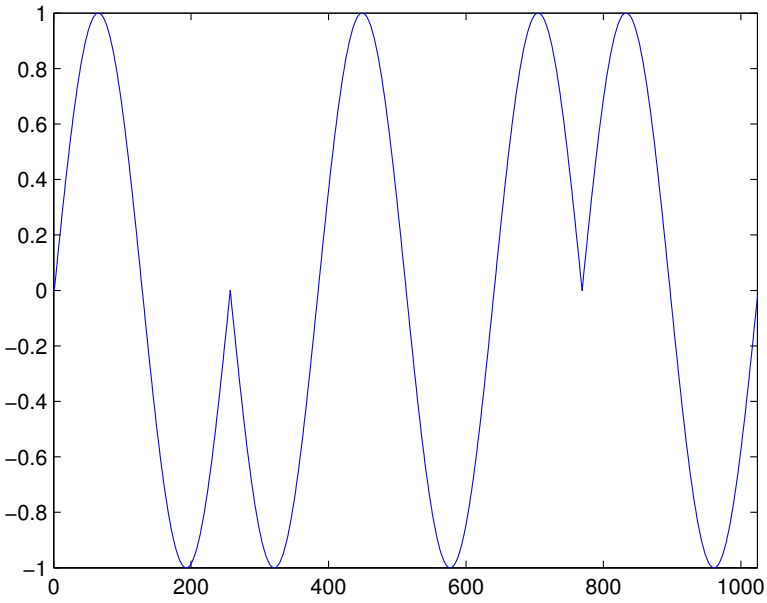

Figure 3: The exemplified $m(t)$ corresponding to bits [1001]. The x-axis is the index of the sample points.

IV. Modulator and Upconverter

Five modulations will be possibly used in this project.

i) DSB-C

ii) DSB-SC

iii) SSB

iv) VSB

v) FM

In other words, TAs will modulate the message $m(t)$ by one of these five modulation schemes selected in a random manner to generate $s(t)$.

V. Channel

This project only assumes a noise-free channel.

VI. Demodulator and Downconverter

This is the part you are required to implement in this project. As you have already known the possible form of $m(t)$, you shall "sense" (perhaps in a try-and-error fashion) which of the five modulation schemes is used for each data file. As long as you argue your results reasonably in your report, you shall get the full mark.

VII. Project Grade

1. (50%) Each student will receive five $s(t)$ files. Recovering one of them correctly will earn you 10% of the grade for the software term project. What will be given to students also include carrier frequency f_c and sampling period T.
2. (50%) The report will gain each student another 50% of the grade. It should include:
   (a) Name and Student ID.
   (b) A table that lists the File Name, the Modulation Type and the Decimal Numbers your demodulator obtained.

File Name	Modulation	Decimal
1.txt	DSB-SC	758
2.txt	DSB-C	128
...	...	...

   (c) A paragraph to describe how or in which manner you design your demodulators?
   (d) For each of the messages recovered, which demodulator (i.e., which modulation type) you are using and why?
   (e) What is the main difficulty you encountered in this project?
   (f) Your demodulator program/code with comments/explanations (either inside the written report or on the program body). This will also be considered a part of the report grade.