ECEG 470/670 Communication and Information Systems Fall 2025

Project #3: Simulation of Delta Modulation

In this project you will modify a Matlab script (m-file) to simulate the application of delta modulation (DM) to a sampled audio signal. The script will generate the DM staircase approximation of the message signal, which will allow you to investigate the effect of changing the amplitude step size *E*.

***Assignment*:**

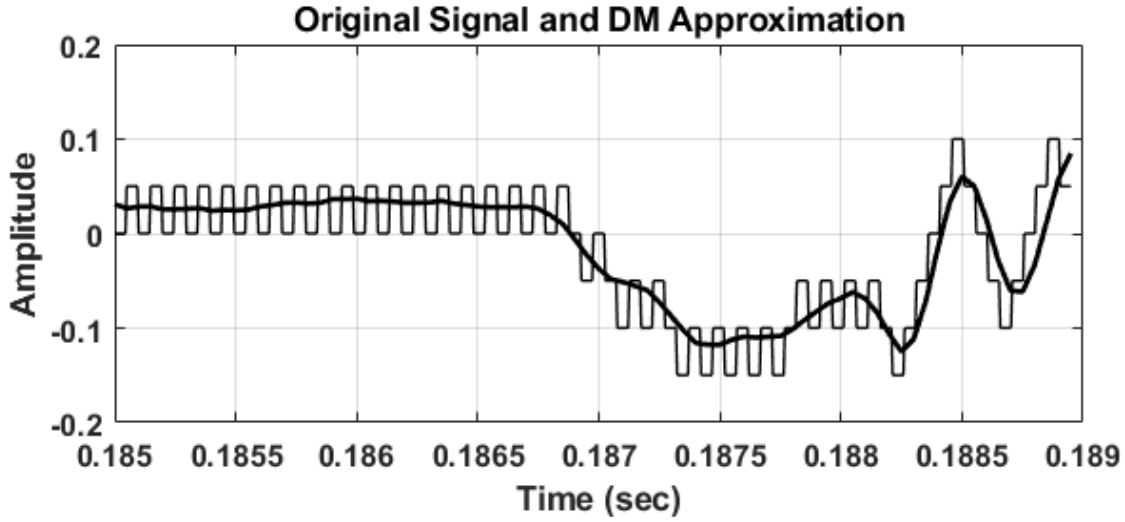
1. Your assignment is to add a few lines of code to an incomplete *Matlab* script (m-file) to simulate the application of DM to a sampled audio signal. Download the files `eceg470project3start.m` and `SpeechSample.mat`, which are both available at the course Moodle site. You should set up a separate folder to contain your work.

   The m-file is heavily commented, and the **place where you need to add code is clearly indicated** by the text "*** ADD CODE HERE ***".

   Add your name to your copy of the m-file in the obvious place in the header.

2. Edit the m-file by adding code that implements the DM algorithm. Around line 59 of the code, the column vector `mq` is initialized with zeros. That vector will hold the approximation of the message signal that your DM algorithm will generate. Around line 61 is the definition of the column vector `msg`. It is initialized with samples of the message signal over the subrange from sample no. 3701 (determined by the variable `i_start`) to sample no. 3780 (determined by the variable `i_stop`). Only a tiny portion of the full message signal will be processed so that it will be easier to see the staircase approximation.

   You should obtain the plot shown below when the amplitude step size is set to $E = 0.05$.



3. After you have confirmed that your algorithm is working, vary the value of the amplitude step size *E*, and find the minimum value that seems to avoid slope overload everywhere in the message waveform. This will be a very rough approximation. Determining the value to one digit of accuracy is sufficient. Add the value of *E* that you found and a brief discussion of your observations as comments after the text "ADD DISCUSSION OF AMPLITUDE STEP SIZE HERE" at the bottom of the m-file.

4. Vary the value of the amplitude step size *E* again, but this time find the maximum value that seems to avoid excessive idling (oscillation between $-E$ and $+E$) over the low-amplitude section of the message waveform. This will again be a very rough approximation, and again one digit of accuracy is sufficient. Add the value of *E* that you found and a brief discussion of your observations as comments at the bottom of the m-file. Also add the ratio of the step size found in Part 3 to the step size found in this part.

5. E-mail to me the Matlab script (m-file) that you modified with comments added by **11:59 pm on Friday, November 14, 2025**. Don't forget to add your name to the header of the m-file.