EE442/EE592 Real-Time Digital Signal Processing
Project #2: Adaptive Noise Canceler/Adaptive Line Enhancer
Due: 5:00pm, Friday, March 11, 2011

Assignment

The goal of this project is to use an adaptive filter to cancel a periodic interference (tone) mixed in a broadband signal of interest (SOI). Students in EE442 will solve this problem using the adaptive noise canceler (ANC) in Figure 1; students in EE592 will solve this problem two ways: using an ANC and an adaptive line enhancer (ALE) in Figure 2. The adaptive filters are adjusted using the LMS algorithm.

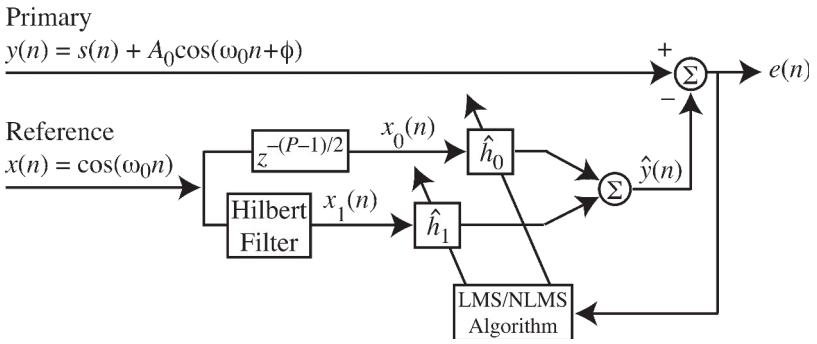

Figure 1: Adaptive Noise Canceler (ANC)

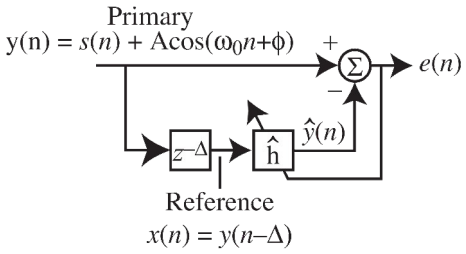

Figure 2: Adaptive Line Enhancer (ALE)

In order to build the input signal $y[n]$ (primary and reference for the ANC and primary for the ALE), download the MATLAB program, add_interference.m. This program will add random tone to the user-supplied WAV file and save the resulting signal as a WAV file.

`http://www.ece.nmsu.edu/~pdeleon/EE592/Freescale_DSP56K_Code.html`

In addition, .dat files for the project can also be found at the above URL.

Algorithm

The algorithms for the adaptive noise canceler and the adaptive line enhancer are given in the text.

Testing

Listening to the output of the EVM will provide the major indicator of whether or not the ANC/ALE is working. Also adjusting the LMS/NLMS step-size and monitoring the adaptation rate will also provide an indicator.

Submitted Items

You will be required to submit several items for this project, described below.

Code Printout

Please turn in a printout of your codes **`project2_anc.asm`**, **`project2_anc.dat, proginit_anc.asm, procster_anc.asm`**, and other programmer-created files (exclude **`ada_equ.asm`**, **`ada_init.asm`**, **`intequ.asm`**, **`ioequ.asm`**, and **`vectors.asm`**). Your codes should be fully documented in the header and completely commented. Students in EE592 will also turn in a printout of **`project2_ale.asm`**, **`project2_ale.dat, proginit_ale.asm, procster_ale.asm`**, and other programmer-created files

Code in Electronic Form

Turn in a USB flash drive (with your name clearly labeled on it) with a directory named ANC containing all files for the ANC. Students in EE592 will also create a directory name ALE containing all files for the ALE. The directory(ies) should contain **ALL** code necessary to assemble the program—we will not struggle to get your code to assemble. Be sure to *include* the files **`ada_equ.asm`**, **`ada_init.asm`**, **`intequ.asm`**, **`ioequ.asm`**, and **`vectors.asm`** in each directory. Do not provide **`.CLD`**, **`.LST`**, or backup files.

Grading

We will evaluate the project code(s). Good noise cancellation will yield +95 points. An incorrect or poor cancellation will scale the point total accordingly. Good commenting adds +1 to + 5 additional points for a total of +100 points. Average commenting and documentation will be worth +3 points. If necessary, we will schedule an appointment to have a demonstration of the code.

Bonuses

You may wish to earn bonus points with the following enhancements to the project. Note that we will only grade one program be it the basic project or enhanced project. It is far better (point-wise) to have a working basic project than a non-working enhanced project.

EE442

Adjust the adaptive filter using the NLMS algorithm (+5 points)

EE592

Adjust the adaptive filter in the ANC and ALE using the NLMS algorithm (+10 points)

Evaluation

EE492

Baseline: Working LMS Adaptive Noise Canceler +95 points. Average commenting and documentation will be worth +3 points.

Deductions:

–5	CD does not contain proper files or contains other files not used in code
–10	$\mu = 0$ produces no adaptation (check memory where $\hat{h}$ is stored to check for change from initialization)
–10	μ small number adapts slowly and misadjustment is not audible (any deviations get deduction)
–10	μ large number adapts quickly and misadjustment is audible (any deviations get deduction)
–40	No Assemble

EE592

Baseline: LMS Adaptive Noise Canceler and Adaptive Line Enhancer +95 points. Average commenting and documentation will be worth +3 points.

Deductions: (same as above)
NLMS bonus testing: Check to see if cases 1 and 2 are working properly for ANC/NLMS. Check to see if cases 1, 2a, and 2b are working properly for ALE/NLMS