Echo Cancellation

Hudanyun Sheng
Industrial and Systems Engineering
University of Florida
Gainesville, United States
hdysheng@ufl.edu

***Abstract*—This paper looked into the echo cancellation problem. In this paper I took the echo cancellation problem as an adaptive filter problem, and introduced several different adaptive filters to accomplish the echo cancellation task. I looked into both FIR filter and IIR filter, and compared their performance, and quantify their performance by echo return loss enhancement.**

***Index Terms*—echo cancellation, FIR filter, IIR filter, Gamma filter**

I. Introduction

As shown in figure 1, caller A at the near end is having some speech, which we want to know, caller B at the far end, while listening, is playing music. However, due to the imperfection of two-wire to four-wire hybrid, the speech at the near end is corrupted, i.e., it is mixed with the echo from music. Our task is to remove the echo from the corrupted speech, thus to recover the speech.

The echo cancellation problem can be viewed as an adaptive

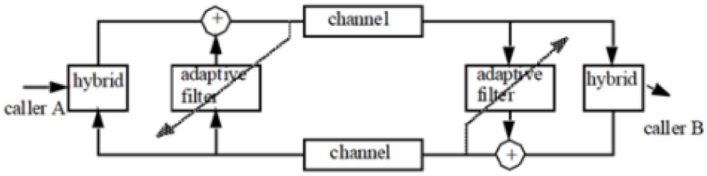

Fig. 1. Diagram of the problem.

filter problem. We are given the corrupted signal, which is the mixture of the desired speech and the echo; we are also given the original music signal which is the reason the the echo. And our task is to cancel the echo from the mixture, by training adaptive filter, i.e. the weight to put on the input signal. We want our filter being able to mimic the way the original signal becomes echo. In that case, the desired output for our filter is the corrupted signal, and the input for our filter is the original music signal, the error, i.e. the difference between desire and error, is the speech we want to recover.

II. Methodology

A. FIR filter

FIR filter are finite response filter,

a) Wiener Solution:

b) LMS Solution:

B. IIR filter

a) Gamma Filter:

III. Results

A. FIR filter

a) Wiener Solution:

b) LMS Solution:

B. IIR filter

a) Gamma Filter:

C. Figures and Tables

a) Positioning Figures and Tables: Place figures and tables at the top and

IV. Discussion

V. Conclusions

Acknowledgment

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