ADAPTIVE ESCALATOR STRUCTURE FOR LINEAR PREDICTION

by

DAE HEE YOUN

B.S., YONSEI UNIVERSITY, 1977

A MASTER'S REPORT

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Electrical Engineering

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1979

Approved by:

Nasir Ahmed
Major Professor

I would like to dedicate this work

to my parents and my wife.

TABLE OF CONTENTS

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

The adaptive linear predictor configuration shown in Fig. 1-1 is a scheme which has found a variety of applications, such as line enhancement [1], spectral estimation [2], speech enhancement [3], and intrusion detection [4]. An integral part of the adaptive predictor is a finite impulse response (FIR) filter, whose coefficients (weights) are updated continuously via a variety of algorithms. They can be updated, for example, using information related to the prediction error e(k) (see Fig. 1-1), using Widrow's least-mean-square (LMS) algorithm [1]. Information pertaining to the input correlation matrix $\Sigma_{xx}(k)$ can also be used, as is the case with a class of sequential regression (SER) algorithms [5,6], one of which [5] is also referred to as Godard's algorithm [7]. The LMS and SER filters are usually implemented in the form of a tapped delay line model (see Fig. 1-2), where $g_i(k)$ denotes the i-th filter coefficient (weight) at time k, N is the number of weights, which also equals the number of past values x(k-1), x(k-2),...,x(k-N) used to predict x(k). This class of filters is optimum in that if the input is stationary,[†] then the predictor weights (or their expected value in the LMS case) converge to the Wiener solution.

Since the SER algorithms utilize information related to the input correlation matrix $\Sigma_{xx}(k)$ to update the filter weights, their implementations involve matrix operations. In contrast, the LMS algorithm involves

---

[†] i.e., the input correlation matrix is positive definite.

THIS BOOK CONTAINS NUMEROUS PAGES WITH DIAGRAMS THAT ARE CROOKED COMPARED TO THE REST OF THE INFORMATION ON THE PAGE.

THIS IS AS RECEIVED FROM CUSTOMER.

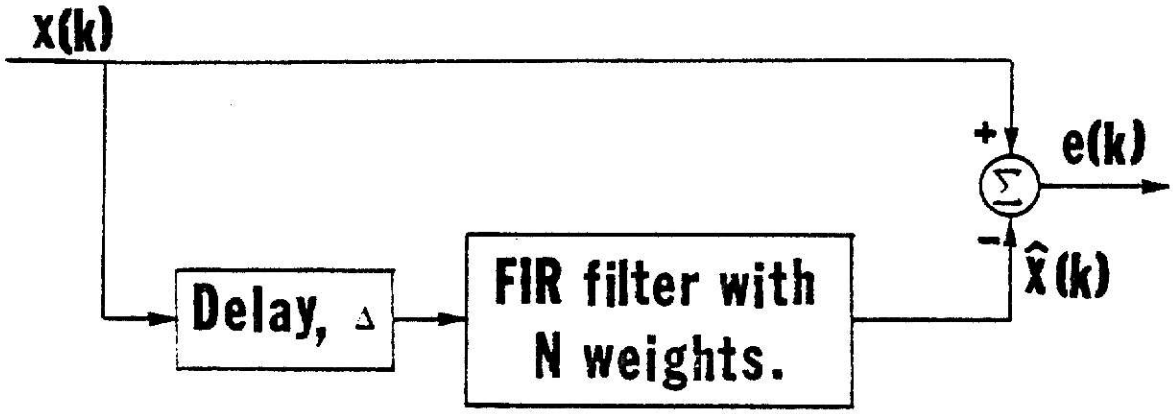

Fig. 1-1. Predictor configuration.

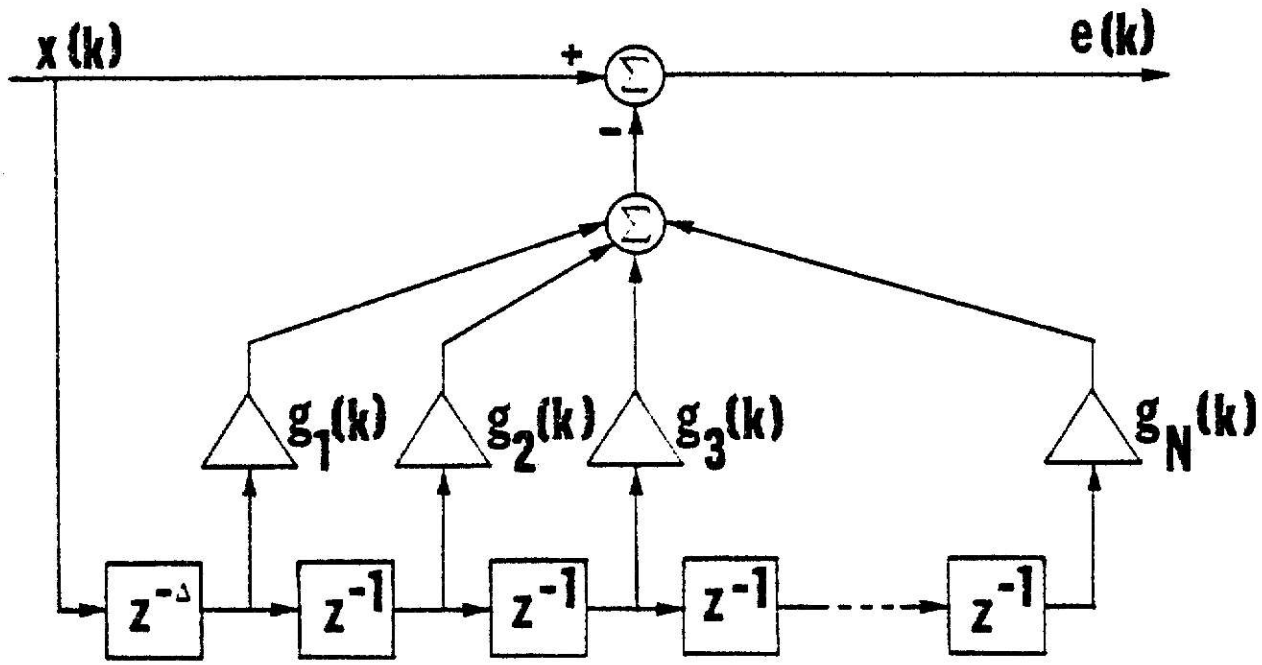

Fig. 1-2. Tapped delay line predictor.