

TRANSFER FUNCTION CONSIDERATIONS OF AN
ADAPTIVE LATTICE PREDICTOR

by

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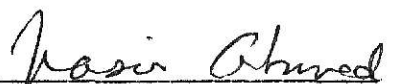
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1. INTRODUCTION

The ADP (Adaptive Digital Predictor) was implemented using Widrow's LMS algorithm [1] as shown in Fig. 1, in connection with an intruder detection application [2]. After the algorithm was used for a period of time, it was observed that the predictor would not only remove correlated noise, but the intruder signal as well. In other words, it gradually became a "no pass" filter.

The above "no pass" phenomenon is best conveyed by a simple experiment that was performed in a laboratory environment. The input to a 16 weight ADP (see Fig. 1) consisted of a sum of two sinusoids of frequencies 8 and 32 HZ. The sampling frequency was 128 HZ and convergence parameter ν in Fig. 1 was 0.02. If both the sinusoids were generated by repeatedly using the exact sample set of the single cycle, the ADP output was essentially zero and the transfer function of its filter portion remained unchanged indefinitely. However, if the sinusoids were generated using the FORTRAN "SIN(A)" Function, where A was varied continuously, the transfer function was found to change slowly with time. This is depicted in Fig. 2 via gain plots. It is apparent that the gain function changes gradually from a narrow-band type with two peaks at 8 and 32 HZ to a more broadband type of function. We also note that the gains at 8 and 32 HZ remained equal to 1 throughout the transition period. As a result, the corresponding ADP output was zero. A related study [3] has shown that this behavior is due to the ADP having more weights than necessary, as was the case in the above experiment, where only 4 weights are necessary to eliminate a sum of two sinewaves. The extra weights strive to remove

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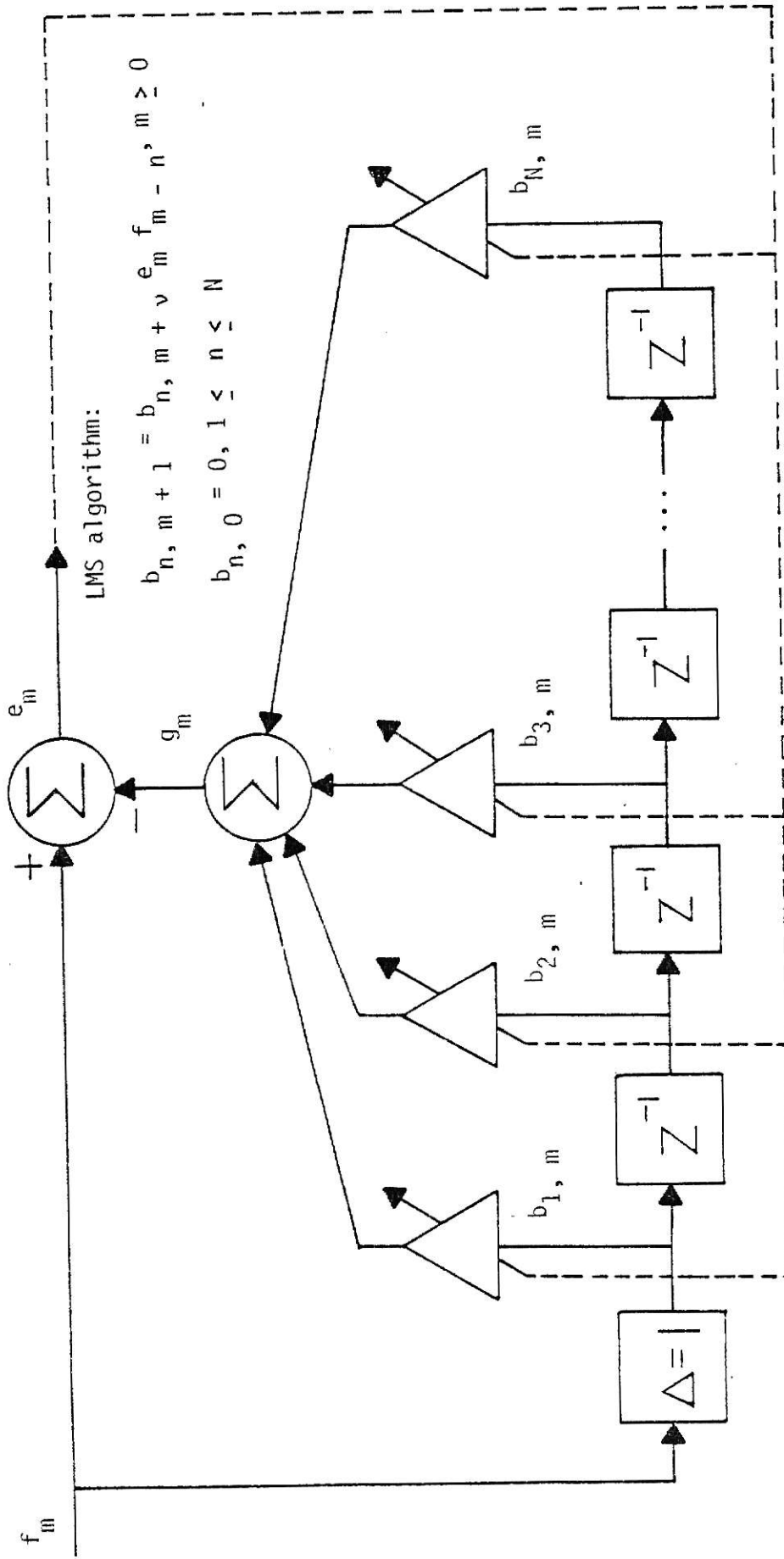


Fig.1. Tapped delay line(or transversal filter) predictor configuration.
 Dashed lines indicate adaptive control loop.