

io-port 00916417**Miyanaga, Yoshikazu****ARMA digital lattice filter based on linear prediction theory.**

Nagai, Nobuo (ed.), Linear circuits, systems, and signal processing: Advanced theory and applications. New York, NY: Marcel Dekker. Electr. Eng. Electron. 62, 281-310 (1990).

This is chapter 10 of the volume under review. In the autoregressive (AR) estimation the Levinson algorithm plays a major role. At the same time, the lattice filter (LF) associated to LA is also of high interest due to the fact that it possesses some advantages over other filter realizations. In the paper the following problem is discussed and solved. Let a system be so that its input x (the samples of x) and its output y (the samples of y) are known (given by some experiment). It is asked to find an auto-regressive moving average (ARMA) model. This problem is formulated as a least squares estimation problem. It is assumed that x and y can be regarded as the outputs of some filters, having their transfer functions H_a for x and H_b for y , each of them fed by white noise. As usually, z -transforms are denoted by capital letters. Then if X is modified by multiplication with a polynomial $B(z^{-1})$ while Y is modified by multiplication with $A(z^{-1})$, the difference $H_b(z^{-1})A(z^{-1}) - H_a(z^{-1})B(z^{-1})$ becomes very small when B/A is very near to $H = H_b/H_a$, the true (but unknown) transfer function of the system. The nearness criterion is in the least mean squares sense. More specifically, the minimum is taken over the integral of the squares. By means of this criterion, one gets four systems of equations providing four prediction errors and the A and B coefficients. By use of them the lattice structure of the filter is obtained. Some remarks about the proposed method would be of interest. The three recursions derived for the calculation of the coefficients are similar to those occurring in the LA. Then, the matrices defining the basic linear systems of equations comprise autocorrelation coefficients of x , y and also the coefficients of the correlation between x and y , since the input and the output are generally correlated. When the input is white noise, the volume of the calculations reduces significantly. A numerical example for speech signals given in the paper validates the proposed method. It should be noted that the optimum shape of the filters (the length of A and of B) can be appreciated after performing a set of designs and finally choosing the case which provides the minimum.

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Keywords: digital filters; lattice filter; auto-regressive moving average; least squares estimation