CHAPTER 6

CONCLUSION AND DISCUSSION

6.1 Conclusion and Discussion

A history about the system identification using the crosscorrelation method is described briefly in chapter 1. When the white noise signal is used as an input signal x(t), eqn. (1.3) can be simplified to the form

$$\phi_{xy}(\tau) = Kh(\tau) \qquad (6.1)$$

Thus, the impulse response is determined by

$$h(\tau) = \frac{1}{K}\phi_{xy}(\tau) \qquad (6.2)$$

If the binary m-sequence signal is used instead of the white noise input signal, we can obtain

$$\phi_{xy}(0) \doteq \frac{a^2 2^n}{2^n-1}\left(\frac{\Delta t}{2}\right)h(0) + A \quad , \text{for } t = 0 \qquad (6.3)$$

$$\phi_{xy}(\tau) \doteq \frac{a^2 2^n}{2^n-1}\left(1 + \frac{2\tau}{\Delta t} - \frac{\tau^2}{\Delta t^2}\right)\left(\frac{\Delta t}{2}\right)h(\tau) \quad , \Delta t \geq \tau \geq 0 \qquad (6.4)$$

$$\phi_{xy}(\tau) \doteq \frac{a^2 2^n}{2^n-1}(\Delta t)h(\tau) \quad , \text{for } \tau \geq \Delta t \qquad (6.5)$$

provided that the settling time of the impulse response is about $\frac{1}{5}$ of the period of the input signal.

There are several methods used in the determination of the crosscorrelation function $\phi_{xe}(\tau)$. A method of assuming the delta function to represent each non zero part of the reversible transition error signal e(t) to determine $\phi_{xe}(\tau)$ was proposed by K.R. Godfrey[8]. This may be done by the inspection technique described in chapter 3. It is seen that the values of $\phi_{xe}(\tau)$ shown in table 3.2 can be reduced to the values of $\phi_{xe}(\tau)$ shown in table 3.1, when the parameters of non-reversible transition error are replaced by the parameters of reversible transition error.

$$\gamma \quad = \quad \lambda \quad = \quad \alpha \tag{6.6}$$

and

$$\epsilon(t) \quad = \mu(t) = \quad \beta(t) \tag{6.7}$$

When the external noise is the time polynomial function signal. It can be seen that the magnitude of the coefficient A_i or the value of the time moment $M_i(\tau)$ can be reduced as much as possible when the suitable starting point of the input binary m-sequence signal x(t) is chosen (see Appendix H).

The technique described in the section 4.3 may also be applied for any unpredictable waveform of the external noise provided that its autocorrelation function or its power spectrum density spectrum is known. When the value of the signal-to-noise ratio is large, the errors of the approximated values of $\phi_{xn_i}(\tau)$ can be neglected for further convenient analysis.

The methods in reducing the errors described in chapter 5 can be summarised as follows:

(a) The value of Δt must be very small comparing to the time constant of the first order linear system.

(b) The transition error should be chosen in the delta function-like form such as the exponential form with the small value of time constant.

(c) The suitable starting point of the time polynomial function noise input signal must be chosen in order to reduce the magnitudes of the time moment.

(d) The value of the signal-to-noise ratio should be large so that the magnitudes of errors caused by another type of external noise are very small and can be neglected.

6.2 Suggestions and Future Research Study

It is seen that the errors discussed in this thesis may not be reduced by the techniques described in section 6.1. Since the capability of equipments or components used in this method are limited. Thus, it is necessary to find another method to identify the linear system or another technique will be used to reduce these errors. Hence, future research study may be summarized as follows:

1. A study of error caused by non-reversible transition error effected in system identification by crosscorrelation method.

2. A study of errors effected in system identification by crosscorrelation method using other types of pseudorandom input signal.

3. Comparision the use of pseudorandom input signals in system identification by crosscorrelation method.

4. A study of the crosscorrelation method in the multi-input and multi-output of the linear system using pseudorandom input signal. These researches are essential works in the identification of linear systems.