CHAPTER 6

SUMMARY AND SUGGESTIONS FOR FURTHER RESEARCH

6.1 Summary

6.2 Suggestions for Further Research
6.1 SUMMARY

The main contributions made in this thesis are summarized as follows:

New algebraic schemes are presented for delivering the reduced order model of a given stable higher order LTICS.

In Chapter 2 a simple guideline is suggested for the choice of the expansion point. This expansion point is used to obtain second and third order models. The better performance of the method as compared to the other schemes [34,56,60] is illustrated through the examples. A new expansion point ‘1/a’ is used if unstable reduced order model is obtained using the expansion point ‘a’. Using these schemes Stable reduced order models can be obtained when the original system is stable.

The newly proposed model reduction scheme based on continued fraction expansion using a Routh Like Table about two points with a particular combination (s = 0, s = a) is found to perform better than other methods suggested in the literature [1,9-10,14,19-20,30,32, 34,38, 54,56-58,65,67,70,73-75] in matching the transient and steady state unit step response.

In Chapter 4, the model reduction suggested in Chapter 3 is suitably extended for designing PID controller, lead compensator, lag compensator and state variable feedback controller, observer and sub-optimal controller. It is found that using the newly deduced set of (K_p,K_i,K_d) ; (K,A,B) ; (A,B) for PID controller, lead phase compensator, lag phase compensator results in optimal response as per the design specifications. The applicability of the suggested model reduction scheme in the estimation of nonlinear critical gain of continuous system is illustrated using examples.
In Chapter 5, the reduced order models for LTIDS are obtained using the two-point expansion scheme with the help of Shamash transformation. The reduced order models are used in the design of PID controller for the original system with unit step input. The closed loop response for a unit step input of the original system with the controller is in agreement with the desired specifications. The two point expansion scheme is also used in the estimation non linear critical gain. It is shown that the proposed scheme is acceptable with the techniques given in [100-102]. The applicability of the two point expansion scheme for designing state feedback controller and observer is demonstrated through examples. The reliability of the system is also evaluated using the cost functions of the optimal control, the higher order system and sub-optimal control of reduced order model.
6.2 SUGGESTIONS FOR FURTHER RESEARCH

On the basis of studies and investigations carried out in this thesis, the following suggestions are presented for further research.

1. The proposed Routh like table can be extended for stability analysis of LTICS with complex coefficients. [106]
2. The scheme may be applied to multidimensional filters for stability analysis and design. [107]
3. Using the newly suggested procedures the design of PID controller and optimal control regulator for Multi Input Multi Output system may be performed. [108 - 109]
4. The proposed technique may be extended for analysis and design of other classes of nonlinear sampled data systems. [99]
5. Extending the concepts and procedures deduced in this thesis, other classes of complex systems viz. Neuro-Fuzzy systems can be handled. [110 - 111]
6. The proposed scheme can be extended for the stability analysis of a certain class of Biological Control Systems. [112]