CHAPTER 6
CONCLUSION & FUTURE SCOPE

6.1 CONCLUSIONS

The novel IPCG method for reducing the order of a system of high order is presented in the research work. The technique is equally applicable to continuous and discrete time systems. Moreover, the IPCG technique is capable to reduce the SISO as well as MIMO systems. Furthermore, the IPCG technique reduces the systems presented in transfer function as well as state space representation. The proposed technique is also helpful in designing of the controller for the power systems. The complete work presented in the thesis is performed by the MATLAB software.

The research work occurred in two parts: first is obtaining the reduction of a system of high order by novel IPCG method, another is to design the LFC controller for a power system. The reduction in order of the system is achieved by IPCG method by blending improved pole clustering method and genetic algorithm. Then nine SISO continuous time systems up to an order of 48 are reduced by the IPCG method. Moreover, three discrete time systems are also reduced and tested for similarity with the system of high order. Furthermore, three MIMO system of continuous time having order up to 19 are also reduced by the proposed method. The system of reduced order procured by IPCG technique is then compared with the corresponding system of high order based on the performance parameters dealing in time domain such as rise time, maximum deviation from desired output (overshoot), time to reach steady state (settling time) and fixed error after reaching final stage (steady state error). Also the value of margins (gain margin, phase margin) in frequency domain is utilised to draw the similarity. The value of these margins also helps to get the measure of the stability. The more performance parameters obtained to compute the difference amongst the system of high and low order is ISE, IAE and ITAE errors value. Moreover, the similarity in the system of high and low order is also checked based on the first three time moments. For all the examples that are reduced by the newly developed IPCG method, it is analysed that the value of all performance parameters

are better than all the methods developed earlier by various researchers. All the errors are seen as providing their lower value and almost similar value of all other parameters. So, based on the research work, the IPCG method is seen to provide following merits which describes the effectiveness of the proposed technique:

1. The proposed technique provides a reduced-order approximation with zero steady-state error, which means that the final value of the approximated system is same as that of the original plant model.
2. All the poles of the original plant are used in the proposed methodology to procure the denominator multinomial of the system of reduced orderr, which signifies that the effect of all poles is considered in the proposed technique.
3. The reduced model's transfer function is obtained by GA, which provides the optimised value of the parameters; hence, a system with increased accuracy is obtained using the proposed method.
4. Stability is the main concern while obtaining the reduced-order model and it is maintained in the proposed methodology.
5. From the time moment analysis, it is clear that the time moments of the system of high and low order are almost same in all examples. So the proposed IPCG technique suit better to procure the approximation of reduced order.

Moreover, the proposed technique is utilised to procure the controller for the power systems. An accurate approximation of reduced order for the power system is procured which replaces the system of high order and hence reducing the complexity involved in the design of controller. The proposed technique is utilised to procure the LFC controller for a single area, a two area and a three area power system. The controller hence developed using IPCG method is found suitable to control the frequency and power deviations in the system in a more effective manner as compared to other controllers developed earlier. The time to get the zero deviation in frequency and power is reduced to a significant value by using the proposed controller. Moreover, the deviation peaks are also reduced, hence reducing the oscillations in the system.

6.2 FUTURE SCOPE

The research work performed in the thesis is suitable to extend. The more development in the MOR technique is possible by utilizing any other evolutionary algorithm instead of genetic algorithm. Moreover, the system of up to 48 orders is reduced in the thesis, so systems of order higher than 48 can also be reduced by employing the reduction method. Furthermore, the controllers for more high area systems can be designed. The power systems may consist some non-linearities like backlash, delays, generator time constant, so the work can be performed in future scope for the removal of these undesired non-linearties.