CHAPTER 6

SUMMARY AND CONCLUSION

6.1 CONCLUSION

In this thesis, an MPC scheme based on nonlinear state estimation procedure has been formulated and applied to CSTRs. The nonlinear state estimation is achieved by using FKF and ASFKF. The FKF is used to estimate the reactor concentration and reactor temperature whereas the ASFKF is used to estimate the reactor concentration, reactor temperature and unmeasured disturbances (augmented states). Further, an NMPC formulation based on Fuzzy dynamic model, FKF and ASFKF has been proposed and compared. Simulation results also include an inferential control case, where the reactor concentration is not measured but estimated from temperature measurement and used in the NMPC based on FKF and ASFKF formulations.

From the extensive simulation studies on the CSTRs, we infer the following:

- FKF is found to be a good alternative for EKF, with the proposed approach being computationally faster than the EKF.
- ASFKF was able to generate accurate state estimates even in the presence of step like input or output disturbances.
- Even for large variation in the setpoint, NMPC was able to track the setpoint.
- FKF based NMPC (Inferential Control Case) was able to achieve satisfactory servo performance whereas in the

presence of step change in the unmeasured disturbance an offset exists between the setpoint and true value of the measured variable.

- ASFKF based NMPC scheme (Inferential Control Case) was able to achieve satisfactory regulatory performance.

6.2 SCOPE FOR FUTURE WORK

The results and issues identified during the course of this work give rise to a number of possible directions of future work. Some of these are briefly summarized below.

- An approach to design a nonlinear observer to estimate the state of noisy dynamic system has been proposed. However, the theoretical properties and stability analysis of the proposed state estimators have to be studied.
- A multiple model predictive control strategy for controlling the nonlinear process at different operating condition has been proposed. Further, the setpoint tracking and disturbance rejection capabilities using the state estimation based NMPC have been demonstrated. However, the stability analysis of the proposed NMPC formulations has to be investigated.
- The efficacy of the proposed state estimation based NMPC has been demonstrated only on the simulated model of the CSTR processes. The real time validation of the proposed NMPC Schemes on the Benchmark processes can be attempted. Further the computational issues of the proposed NMPC are to be explored.