CHAPTER V

CONCLUSIONS AND RECCOMMENDATIONS

5.1 Conclusion

In this study, we have presented a simulation-based methodology for evaluating flowsheet design and control alternatives with regard to their controllability and closed-loop behavior. The systems approach is illustrated with an industrial case study on the reaction section of HDA process. It is shown that the combination of steady-state and dynamic simulations, together with a linear controllability analysis in the frequency domain.

In this case, we consider the two control structures that were designed by Kietawarin (2002). Two of these structures are evaluated and compared based on rigorous dynamic simulation. A rigorous dynamic model for a realistic process, namely, HDA process was successfully developed using the commercial software, HYSYS.PLANT. The dynamic model was then used to apply and evaluate the system approach of Groenendijk et al. (2000) for selecting plantwide control structures for the HDA process.

In this approach a decentralized control structure is selected that contains only control loops with one input and one output. Furthermore, the inputs and outputs are arranged in such a way that the proportional gains in the corresponding controller matrix are on the diagonal, which explains the synonym "diagonal" control. The manipulated variables belong to different units, as could be expected from the steady-state analysis. A steady-state analysis alone turned out to be insufficient to obtain this result. So the controllability analysis was used to predict the interaction between the controller.

This proves that a linear controllability analysis in the frequency domain with tool like RGA number, PRGA and CLDG is useful and is capable of discriminating between flowsheet and control structure in an effective way. In particular, using the controllability analysis it appeared that the problems mainly come from the interaction between the different units in the flowsheet. These solutions also are not as easily detected by intuitive means, and stress the importance of controllability tools even more.

The case study focused on the only reaction section of HDA process. The steady-state analysis suggested using the control structure 2 to control the reaction section of HDA process. However, dynamic simulations showed the responses happen drastically of the three control structure, and some loop control of the reference control structure and the control structure1 have oscillation and become into the new steady-state slower that the second one, when a step of manipulated variable increased.

Controllability analysis described by PRGA and CLDG. For setpoint tracking the bounds are given by the performance relative gains and for disturbance rejection by the closed-loop disturbance gains. For PRGA, the response of the control structure2 can give the result into satisfied bound. That means the effect of changing setpoint is less than the reference control structure and the first one. However, for CLDG gives the result that the reference control structure and the first control structure can inject the disturbance better than the second one. The considered disturbances are the temperature of FFtoluene stream and pressure of FFH2 stream.

However, importantly, these bounds depend on the model of the process only, that is, are independent of the controller. This means that frequency-dependent plots of PRGA and CLDG may be used to evaluate the achievable closed-loop performance (controllability) under decentralized control. Plants with small values of these measures are preferred. Furthermore, the values of CLDG may tell the engineer which disturbance k will be most difficult to handle using feedback control. This may pinpoint the need for using feedforward control, or for modifying the process. Therefore, a good and reliable plant-wide control design method should combine both systematic analysis and engineering judgement

5.2 Recommendations

1. Study and design the control structure of heat-exchange network of HDA process in plantwide control point of view.
2. Study and improve the methodology of tuning PID plantwide control of HDA process