

A Decision-Based Methodology for Plantwide Control Structure Synthesis

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Abstract

The synthesis of plantwide control structures is not a new area of study but presently there is no agreement on a unified approach to this problem. One reason for this is the large dimension of the problem that involves many manipulated and controlled variables. Recent work by [?, ?] has shown that the dimensionality of the plantwide control problem can be reduced by decomposing the process flowsheet into subsets of the flowsheet, or modules, using a decision-based approach known as the *modified* Analytic Hierarchical Process (*mAHP*) [?]. The natural interactions and dependencies inherent in the plantwide control problem dictate the decomposition process, while still retaining the integrity of the plantwide problem. The modules that result are more tractable to design a control structure without loss of performance of the overall process. Thus, the control structure is developed only as it pertains to the module and not the entire process, while satisfying the overall plantwide control objectives.

In this work, the *mAHP* is used to demonstrate selecting between competing flowsheets and their respective plantwide control structures based on a quantitative analysis that incorporates more than purely economic considerations. This capability to assess the control objectives differently between alternatives provides flexibility that is not present in the traditional approaches, thus making the *mAHP* methodology more generalizable to various different processes.

The results are demonstrated on two alternative process flowsheets that produce benzene by the hydro-dealkylation (HDA) of toluene. The HDA process is a well studied example in the open literature [?] and therefore provides a good basis by which to demonstrate the usefulness of the methodology.

References

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