

Project outline

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Scope:

Understand the working principle of a distillation column and build a simulink model with functions defined by a matlab file for the inputs and outputs of a distillation column. Control the variables and state variables in it through control laws like MPC, adaptive control etc.

Motivation & objective:

As a key separation equipment in the chemical industry, the efficient operation of distillation columns is directly related to the economic benefits of production and product quality. However, the complexity, multivariate nature and dynamic characteristics of the distillation process make the control of distillation columns extremely challenging. Traditional manual operation and simple control methods are difficult to cope with frequent load changes and disturbances, so the introduction of automatic control systems is particularly important. The main motives for automatic control of distillation columns include the following aspects: firstly, the automatic control system can accurately regulate the operating parameters in the distillation column, such as reflux ratio, heating power, etc., so as to ensure the stability and efficiency of the separation process, and to improve the production efficiency and product quality; secondly, the automatic control system can monitor and regulate the operating status of the distillation column in real time, detect and deal with abnormal situations in a timely manner, enhance the safety and reliability; In addition, through the automatic control system, it can realize the optimized operation of the distillation tower, reduce energy consumption and material consumption, and lower operating costs; At the same time, the automatic control system can flexibly respond to different process requirements, adapt to different production tasks, and meet the needs of complex processes; Finally, the modern automatic control system integrates advanced sensors and data analysis technology, which can real-time collect and analyze the distillation column's Operation data, these data can not only be used to optimize the current operation, but also for long-term production planning and process improvement to provide strong support. In summary, automated control of distillation columns can not only significantly improve productivity and product quality, enhance safety and reliability, and reduce operating costs, but also meet complex process requirements and support data-driven decision-making. Therefore, the study and realization of automatic control of distillation columns have important practical significance and wide application prospects.

Aim of the project:

The first phase of the project will focus on understanding the dynamics of the distillation column and being able to properly use the existing distillation column simulation provided by the project director. The second phase of the project will focus on the implementation of the multi-SISO control loop and its subsequent tuning and evaluation when different disturbance scenarios are encountered. The final phase of the project will focus on the implementation of a multivariate control scheme, which may take the form of using a dynamic decoupler or model predictive control, either of which should be able to adequately address the interactions between the various process variables.