A Study on Chemical Process Control Strategy Based on Petri Network

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Abstract: Petri network refers to the decentralized control system, which can integrate computer technology, data communication and display technology to realize the automatic control of working procedures. This paper first analyzes the connotation and advantages of Petri network technology, then analyzes the application of Petri network technology in chemical process control, and provides theoretical and practical help for chemical enterprises to introduce Petri network technology to enhance the effectiveness of chemical engineering control.

1. Introduction

In the production process of chemical enterprises, more processes and materials are involved, which puts forward higher requirements for system control. Traditional control technology shows the problems of slow control response speed and poor control effect in chemical process control. Petri network technology is used in chemical process control to help chemical enterprises solve process control problems and ensure chemical production is carried out in a stable and orderly manner.

2. Application of Petrochemical Process Automation

the combination of cybernetics and technical system automation, through the study of control and system science, we can understand the characteristics of the controlled object and environment. on the basis of active collection and application of information, through the application of control function, we can ensure the normal operation of the system and stipulate the predetermined function. in this process, the controlled object usually represents the operating machine, device or production process that needs to be controlled during production, such as oil and gas quality. when different intelligent instruments (measuring devices) are used, the control quantity or output quantity is detected; it is used to process the component feedback signal through the logic of the control system. after the comparative analysis of the deviation, the structural response is performed and the deviation control is identified. the use of automation products in petrochemical enterprises includes process control instruments, control systems, control, etc. The market use scale of process control instruments is the largest, including temperature, flow rate, pressure, liquid level, analysis and so on. China's automation demand is strong, large and medium-sized petrochemical enterprises in the production process to achieve a certain degree of automation, with significant economic benefits, small petrochemical enterprises can rely on mainstream automation to integrate relevant information into the workshop. If automation technology gradually has a higher level of intelligence, people will also continue to optimize the way of calculation and processing, but because of the complex production process of petrochemical enterprises and the poor stability of products, the quality of automation products put forward higher requirements to solve the key problems.

2.1. Technical Analysis of Petri Networks

This technology refers to the decentralized control system, which mainly takes the advanced technology as the computer to effectively control the chemical equipment and production process, and has two functions: centralized operation and decentralized management. Compared with

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traditional control methods, Petri network technology has the following advantages in chemical process control:

Stability. Compared with the traditional control methods, the distributed control system has computer-based accuracy, which can improve the stability and reliability of the control. At the same time, the use of computer functions is more common in the continuous updating and upgrading of Petri network technology. This can greatly improve the ability to monitor and analyze data and improve the effectiveness of control.

Transparency. In the chemical process control of the distributed control system, the open function can simultaneously monitor the data from different monitoring points, integrate the data content, realize the exchange and joint analysis of the monitoring data, make the monitoring results more comprehensive and accurate, improve the quality of chemical process control, and ensure safe and efficient production.

As information technology is constantly updated and upgraded, Petri network technology is also in a dynamic state of change. Petri network technology is an important legacy to avoid the abolition of traditional decentralized control systems; technicians in chemical enterprises can update and upgrade traditional decentralized control systems by optimizing hardware or software to have all the functions in new systems and improve control.

In the decentralized control system, technicians usually choose the building block structure, which has remarkable compatibility and expansibility. under different conditions of chemical enterprises, the corresponding systems and functions can be configured to improve the flexibility and relevance of chemical process control, and to realize the effective control of chemical production, as shown in figure 1.

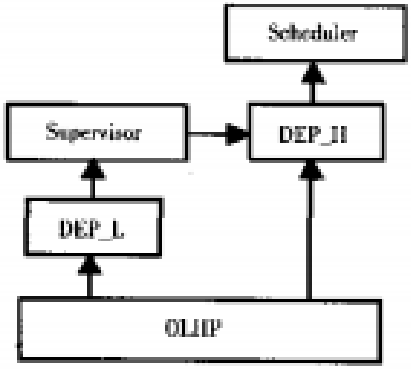

Figure 1 Control process

3. Application of Petri Network Technology in Chemical Process Control

3.1. Control of Reaction Temperature

reactor reaction temperature is one of the important factors affecting the quality of chemical products, and also an important factor affecting the safety of chemical production. when there is too much heat accumulation in the reactor, it will lead to safety problems. Control reactor temperature. At present, the temperature control of the reactor in chemical enterprises includes three links: heating and recovery, transition and constant temperature and constant pressure, among which the temperature control of constant temperature and constant pressure link is the most difficult. Because of the large volume of the reactor, the temperature measurement is prone to deviation, which leads to a large deviation between the measured temperature and the actual temperature; the best way to solve this problem is to adopt Petri network technology, chemical enterprises adopt Petri network technology, and relevant field instruments and equipment to establish a reasonable automation system to achieve the purpose of constant temperature. For example, in order to ensure the constant reaction temperature during the operation of the device, chemical enterprises should adopt the principle of step-by-step control in the Petri network control system to ensure that: the consistency

between the measured value and the determined value, under the influence of cascade control, can quickly eliminate the interference which sometimes affects the temperature change, and ensure the temperature is constant.

3.2. Liquid Level Control

In the aspect of liquid level control, the precision of liquid level control can be improved by establishing liquid level control system. The reason of designing cascade control system is that different reactors are connected with each other in chemical production. front tower is the feed of the rear tower, and the relationship between the front tower and the rear tower should be stable and balanced in order to achieve stable and orderly chemical production. therefore, chemical enterprises need to introduce differential scanning calorimetry (DSC) technology to establish a liquid level control system. chemical enterprises such as installing liquid level regulator and flow controller are to establish a liquid level control system within the reaction size. the output value of the flow controller is defined according to the output value of the liquid level regulator to ensure of liquid level between adjacent reaction sizes. The liquid level of chemical enterprises is constructed by technical means. During the operation of the system, the release circuit can ensure the stability of the material flow, enhance the control effect of the liquid level, and avoid the economic loss caused by the waste of materials in chemical enterprises.

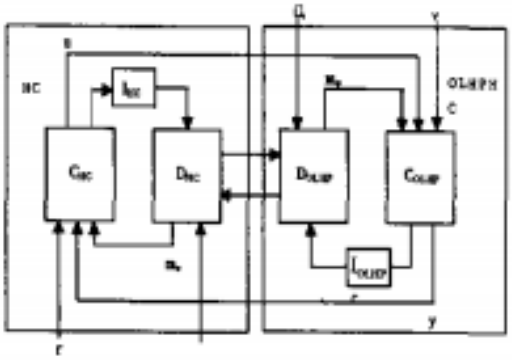

Figure 2 Liquid level control

Based on the DSC technology, chemical enterprises can carry out automatic control of liquid level at the same time, technicians can install sensors in the reaction tower to understand the real-time remote monitoring of the liquid level in the reaction tower, and the level safety threshold is set in the control center. If the liquid level exceeds the safety margin, it will alarm the Petri net in time, remind the staff to adjust the reactor flow rate in the reactor tower, realize the effective and correct control of the liquid level, reduce the labor cost, and improve the efficiency and quality of chemical production.

3.3. Chain Control

In chemical process control, chemical enterprises can implement chain control through decentralized control system. Among them, chain control refers to the clear protection mode of chemical equipment calculated by computer network independently, which can realize the automatic protection of equipment and ensure the safety of chemical production. For example, in the chemical equipment leakage or leakage problems, chain control can automatically close the corresponding valves to protect the chemical equipment. In valve control, the specific opening is calculated by computer. Compared with the traditional chemical equipment management, the chain control has faster response speed and strong reliability, which can prolong the service life of chemical equipment.

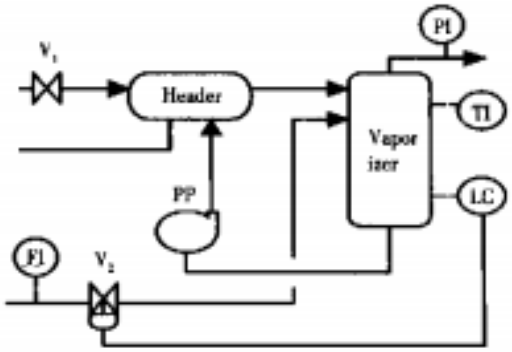

Figure 3 Linkage control

4. The Key of Petrochemical Automation Technology

4.1. Information Processing

Information technology can be described as the basis of comprehensive automation technology of petrochemical enterprises, including information integration, mining and appreciation. Information integration system can directly reflect the abstract production state after collecting data and calculating processing. In the integrated automation system, the database has two kinds of real-time and relationship, which can be realized without data storage, which can help the staff to identify and utilize the information effectively.

4.2. Process Simulation Technology

Process simulation technology can be described as the key to achieve optimal control. Under the process simulation construction and process optimization operation, it can help technicians to choose the feeding ratio and reaction conditions which can make the production profit increase. Now, the promotion of the original utilization rate has become the consensus of the industry, through the application of process simulation technology can be adapted to the market related to the supply of raw materials, product demand dynamic change demand, flexible control of product production. The construction of digital model is the key of process simulation technology, and the production process of each product is different, and it is also related to complex problems such as reaction mechanism and information processing, so it is difficult to construct mathematical model.

4.3. Scientific Decision Support

If petrochemical enterprises want to realize the promotion of market competitive advantage, they must carry out the production decision with technology, science and pertinence. Therefore, during the production of petrochemical automation technology, it is necessary to improve the previous random production decision and carry out cost-benefit and break-even analysis. Through the cost-benefit analysis, the comprehensive economic index of the enterprise is obtained; through the break-even analysis, the production plan is reasonably formulated, so as to effectively control the operating cost and promote the realization of profit maximization.

4.4. Development Trend of Process Control Automation in Petrochemical Industry

On the one hand, the trend of automation hardware development. At present, the development of automation hardware tends to be integrated, networked, digital and intelligent. The network communication technology, computer technology, micro-electronics technology and information processing technology have made the development and upgrading of automation-related hardware possible. At the same time, the instrument detection and control system has been innovated again to face the future in a more high-speed, safe, reliable and simple way. Intelligent processing can not only realize signal processing, but also support self-diagnosis and adjustment. High stable, high precision, high adaptability, high reliability and low consumption information sharing platform, can

connect the control network in real time, while the open core can open and interconnect a variety of intelligent devices.

5. Concluding Remarks

to sum up, Petri network technology has rich control function, which can strengthen the quality of chemical process control and ensure the orderly progress of chemical production. According to the analysis of this paper, Petri network technology can be used in reactor temperature control, liquid level control and chain control in chemical process control, improve the quality and efficiency of chemical production, and promote the sustainable development of chemical enterprises.

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