Practice and Application Analysis of Prediction Control of Mechanical Systems

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Keywords: Mechanical systems, Predictive control, Intelligent control, Application analysis.

Abstract: In the course of the development practice of mechanical system, some mechanical system engineering has been automated and achieved good results. Predictive control uses computer to simulate its control mode, so that computer control technology reaches or even exceeds the level of human beings. Predictive control is the product of scientific and technological development, and the integration with mechanical system makes mechanical and electronic engineering more operable, and thus effectively improves the efficiency of mechanical system. Predictive control is one of the effective means to promote the safety and stability of mechanical systems, and it is also a hot issue in academia and industry. Predictive control technology can be used in the course of industrial economic development or in the course of actual work. This paper expounds the research status of prediction control, analyzes the application of mechanical system of predictive control, and makes suggestions on the application of prediction control, which is of positive significance to the optimization of prediction control of mechanical system and the production efficiency of industrial engineering.

1. Research Background

1.1 Literature review

In the process of mechanical system engineering development, predictive control engineering technology can be used to optimize the production efficiency of mechanical electronic products. Zhu Qi pure lying the basic concept of prediction control in mechanical system, focusing on the application of intelligent control engineering in mechanical and electronic engineering (Zhu 2019). By studying the mechanical system, Liu analyzed the application of the mechanical system combined with the prediction control technology after analyzing the control system related to the mechanical engineering. It is understood that the actual productivity of mechanical systems can be improved by the combination of predictive control technology and mechanical system engineering (Liu 2019). Wu Guangrong focuses on the application of predictive control engineering in mechanical systems. It is proposed that the mechanical system has developed from the initial automation to the intelligent, in which the security and stability of the prediction and control in the control engineering can affect the operational stability of the mechanical system (Wu 2019). Predictive control is a new control algorithm that has emerged in recent years, and it has gradually matured with the development of control technology and research and application (Liu 2018). Wang Shu, through the development of predictive control and the current situation of algorithms, expounded the current prediction control in the field of industrial control development, the current situation of algorithms and the future research prospects (Wang and Wang 2019).

1.2 Purpose of research

In recent years, with the continuous progress and development of industrial production, the application of forecast control in industrial machinery systems has become more and more popular. On the one hand, predictive control has the characteristics of being able to adapt to the control of complex production process, and with the continuous development and perfection of the prediction system in theory and application, it plays an increasingly important role in the mechanical system. On the other hand, predictive control technology has strong vitality, it has the characteristics of not being very dependent on mathematical model, so it shows the broad application prospect in

  DOI: 10.25236/scmc.2019.060

mechanical system. Moreover, the emergence of the control system has brought great convenience to the mechanical system. However, because the prediction control system still has a certain degree of imperfection in the actual operation process, it is necessary to make full use of the prediction control system and make the prediction control system give full play to its value. Therefore, after analyzing the practical application of mechanical system in prediction control, combined with the development of the times, the corresponding application suggestions are put forward for the prediction control of mechanical system, hoping to make the prediction control get better development in the mechanical system.

2. The current state of mechanical system prediction control

A mechanical system consists of several devices, components, and parts. From the theoretical aspect of research, the study of predictive control model has experienced a period of development, the current prediction control theory mainly includes robustness and stability, in addition to the prediction control theory also has the tracking performance and anti-jamming performance of the study(Wang and Liang, 2018). Robust analysis in the modeling process will have some errors, and the application of the field of research results are rare(Xi, 2018). The factors that affect the prediction control are the influence of parameters on robustness, stability, etc., on the other hand, the stability of object matching and the analysis of the model. Theoretically, the theoretical research on the prediction control of mechanical systems focuses on operational mechanism, stability and dynamic static waiting. The commonality of various prediction control algorithms can be used to further understand and study the prediction control through the format of the unified prediction control algorithm. However, most of the existing theoretical analysis and research focus on the algorithms of various models, adapting to the actual needs of industry from the basic algorithms of the models. Predictive control can help people solve practical problems in complex industrial processes, which can be applied to various industrial sectors such as mechanical power, light industry, petroleum, chemical industry, national defense, and so on. Predictive control can break through the ideological constraints of traditional control, create new control strategies and obtain more information about the operation of mechanical systems(Zhou, 2019).

3. Practical application of mechanical system in prediction control

3.1 Application in high-speed hydraulic press

Nowadays, with the continuous progress of industrial development, people's demands on the production process are getting higher and higher. The prediction control is the most novel and advanced mechanical system control method, which introduces new ideas, new methods and more advanced control strategies in the practical application of mechanical system. At present, in the process of hydraulic technology development, in order to meet the changing high standards of high-speed hydraulic machine production needs, it is necessary to greatly improve the pressure and operating speed of its equipment, improve the quality of high-speed hydraulic machine, which has a very large load impact on the equipment. This can easily cause the equipment in the operation of the system overload situation, for the safety of high-speed hydraulic machine and the accuracy of the operation will have a serious impact. The corresponding prediction model can be established according to the actual situation of high-speed hydraulic machine by applying large and high-speed hydraulic machine stousby through the gradual prediction control technology. Predictive control technology can help the high-speed hydraulic machine speed and pressure to a large extent to play a control role, and can help high-speed hydraulic machine to determine accurate Yuxing error. In the course of operation, the high-speed hydraulic machine is controlled more precisely, and can effectively eliminate the equipment error caused by the high-speed hydraulic machine due to unstable operating speed and overload pressure.

3.2 Application in mechanical and electronic engineering

In the process of mechanical and electronic engineering, the prediction system can be applied to

a variety of prediction control techniques. The relevant mechanical and electronic equipment is more accurately predicted, and then the mechanical equipment is controlled precisely according to the forecast results, so as to meet the production requirements of mechanical and electronic engineering. The operation of mechanical equipment should be timed detection, the prediction control technology can provide accurate information for the detection and prediction of mechanical equipment, and the prediction control measures are determined by the prediction results. During the operation of some mechanical systems, when the mechanical system is overloaded, the system can be severely impacted and even caused by system confusion. The equipment load and operating speed and other parameters can be monitored, controlled and analyzed in real time by predictive technology, which can guarantee the production accuracy of mechanical system. Make full use of intelligent control technology to avoid major accidents in the operation of equipment and ensure the safety of personnel and equipment. Only in this way can we meet the production requirements of enterprises and improve their production efficiency.

3.3 Application of boiler control, fractionation tower control and petrochemical plants

Predictive control model has been widely used in mechanical engineering. For example, predictive control techniques are used in industrial boiler control, catalytic cracking of chemical reactors, control of high temperature diffusion furnaces, and paper quantification and automatic water control . The prediction control of mechanical system has been widely used in industry in recent years. For a long time, mechanical system prediction control has been the focus area of scholars' research, and has attracted much attention and attention for several years. By processing, input, output, and analyzing the data of the mechanical system, the mechanical system can be adapted to the open ring instability and the non-minimum phase system by using the predictive control model.

4. Recommendations for the application of mechanical system prediction control.

4.1 Building a high standard of information prediction model

Predictive control is also called model prediction control, predictive control can not be limited in the narrow mathematical model, prediction control is not limited in the form of right structure, as long as the data information entered by the prediction model can be accurate to ensure a higher precision prediction. By widening the prediction model without the limitations of traditional mathematical models, a new model framework and methods are established to reduce the pseudo-information prediction model. Only functional requirements. Mathematical models such as the state equation model, the step response model of DMC, the pulse response model of MAC, and the data collection can all be used for predictive control. Predictive control breaks through the original algorithmic framework. Predictive control can integrate all kinds of effective information processing methods, apply the development and practice of new computer technology such as artificial intelligence, artificial neural network and fuzzy control to establish high standard information prediction model, and develop to the high-precision, multi-modal level .

4.2 Establishing a sound feedback correction method

It is necessary to establish a high-precision prediction model because the pre-test information obtained from the process in the prediction control of mechanical system is insufficient, the information obtained by the process time change has error, etc. makes the prediction inevitably have error, the prediction effect and information obtained, the general is to obtain the parameter information error the greater the prediction result error. Therefore, the establishment of online prediction error feedback is an important step to solve such problems and improve forecast control. The feedback correction mechanism is introduced in the prediction control of mechanical system, or the prediction error is reduced by realizing the online correction by the identification of model parameters. At present, there are not many methods of mechanical system prediction feedback correction, such as correction prediction controller, and there are many shortcomings in not

achieving the prediction effect. In addition, the phase-weighted correction method can also be used to process the prediction model error, but the above-mentioned feedback correction method is also very effective, therefore, the scholars need to further study the prediction feedback correction method.

4.3 Research ingress with new rolling optimization strategies

Rolling optimization strategies are important. Online scroll optimization is a new rolling optimization strategy, the optimization of predictive control, the key strategy is to require the export of different controller structures. At present, the implementation of optimization prediction control under the condition of constraint optimization and multivariate variables shows that the prediction theory is not enough to meet the needs of the current engineering application, so the study of the robust and well-controlled forecast controller structure and package design is very important to the rolling optimization strategy. By designing a new prediction controller, we can choose the rain flower strategy to influence the prediction control effect, aiming at the control effect and adaptability.

4.4 Introduction of adaptive predictive control technology

Adaptive prediction control can describe a kind of predictive control technology that deals with the uncertainty of model objects and the mismatch of robust prediction control.

The principle of adaptive prediction control can effectively reduce the uncertainty in prediction control by learning from the external environment and modifying its own model or adjusting parameters and strategies through system identification and neural network modeling. The combination of predictive control and adaptive control can improve the adaptability of predictive control to the uncertainty of mechanical system, and also enhance the robustness of adaptive control. The introduction of adaptive mechanism in the prediction control of mechanical system can improve the adaptive ability of the prediction control system to the uncertainty of the mechanical system environment. The theory of adaptive prediction control of linear system is relatively broad, and there are few literatures on adaptive prediction control applied to nonlinear systems.

Predictive control should draw on the mature theory of adaptive control, weight the forecast expansion and performance index, and make the adaptive prediction control algorithm apply to the control of mechanical system with nonlinearity through physical quantity.

5. Conclusion

With the development of national economy and scientific and technological progress, the development of mechanical system information and intelligence is the future development trend, industrial engineering will predict the control technology and mechanical system integration is conducive to the prediction control model will be mechanical electronic engineering design perfect, to achieve the accuracy, stability and safety of mechanical system, Prediction control has been widely used in mechanical engineering, and combining predictive control with mechanical system is the trend and future of the times. It is not difficult to see that with the development and progress of prediction control in theory and application, the application potential of mechanical systems in industrial production will be more significant.

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