Dynamic Performance Analysis and Optimization Design of Machine Mechanism Based on Advanced Algorithms

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Abstract: In order to effectively operate the application mechanism system and reduce the application risk of dynamic performance monitoring of machine mechanism, this study deeply explores the application characteristics of the dynamic performance of machine mechanism, and uses advanced algorithmsCreate a dynamic performance monitoring model of the machine mechanism. In this study, the operability of dynamic performance monitoring of machine mechanism is indexed through the application of practical cases, and the dynamic performance analysis and optimization design effect of machine mechanism are compared with advanced algorithms, so as to clarify the effectiveness of advanced algorithms. Obviously, if the operation of dynamic performance monitoring of some machine mechanisms can be reasonably applied, the development loopholes of dynamic performance monitoring of machine mechanisms can be significantly reduced.

1 INTRODUCTION

In the dynamic performance analysis and optimization design of the machine mechanism, the application of the index system is mainly used to realize the field form of the dynamic performance monitoring of the machine mechanism with advanced algorithms (Behroz, and Baseri, et al. 2024). Combined with the traditional machine mechanism requirements, a single operation and application mode is adopted, which leads to a serious waste of machine mechanism design resources (Chen, and Chen, et al. 2023). The dynamic performance monitoring system of machine mechanism has the characteristics of fast operation and high index efficiency, and at the same time, the advanced algorithm also shows the advantages of sustainable upgrading in the dynamic performance analysis and optimization design of machine mechanism (Fan, and Li, et al. 2024). Therefore, it has become an inevitable trend in the development of modern machinery to promote the optimization and upgrading of the field of machine mechanism and vigorously promote the operation of the dynamic performance monitoring system of machine mechanism (Li, and Yang, et al. 2023).

2 RELATED WORKS

Nowadays, the field of machine mechanism started relatively late, and in its development, it is restricted by various factors such as dynamic performance analysis and optimization design environment of machine mechanism, resulting in its overall technology upgrade and optimization progress is relatively slow (Meng, and Hao, et al. 2024). However, in recent years, with the support of national policies, the development of the field of machinery has once again ushered in new opportunities (Nematov and Berdiev, et al. 2023). Up to now, many studies on the application of machine mechanism mainly focus on the dynamic performance monitoring and evaluation of machine mechanism, the application of indicators and the integration of machine mechanism (Ran, and Song, et al. 2024). For example, scholars have made scientific analysis and accurate evaluation of the application of dynamic performance monitoring of machine mechanisms (Tabakovic and Zeljkovic, et al. 2024). Scholars have conducted in-depth research on the impact of dynamic performance monitoring, further discussed the driving force of dynamic performance monitoring of machine mechanisms, and also gave some specific dynamic performance analysis and design schemes of machine mechanisms.

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The team of scholars conducted an in-depth discussion on the influencing factors in the application process of dynamic performance analysis and optimization design of machine mechanism in the aspects of dynamic performance monitoring, fusion and application of machine mechanism (Yamazaki, and Seki, 2023). Scholars have deeply analyzed the basic differences between the dynamic performance monitoring of machine mechanisms and the traditional model. From another point of view, the research on the development of the field of machine mechanism mainly focuses on the analysis of development and the evaluation of development influencing factors, for example, scholars analyze the influencing factors of the dynamic performance monitoring operation of machine mechanism from the aspects of operation application and optimization design (Zhu, and Zhao, et al. 2024). Scholars study the influence of advanced algorithm technology on the development of dynamic performance monitoring of machine mechanism, so as to accurately analyze the development of machine mechanism field.

In order to solve the problem of the operation and development of the dynamic performance monitoring application of the machine mechanism, this study uses an advanced algorithm to solve the problem of the dynamic performance monitoring model of the machine mechanism, firstly uses the basic advanced algorithm to analyze the constructed operation model, and then on this basis, effectively improves the application scope and depth of the advanced algorithm to ensure the construction and application effect of the dynamic performance monitoring system of the machine mechanism.

Therefore, taking the application scheme of a machine mechanism as an example, considering that the problem handling mode of the advanced algorithm is continuous, the specific operation method is to arrange the dynamic performance monitoring application links in ascending order, so as to promote the follow-up task of dynamic performance monitoring of the machine mechanism.

Therefore, this study needs to focus on the development of dynamic performance monitoring of machine mechanisms, and construct a mathematical calculation model with the goal of dynamic performance analysis and optimization design of machine mechanisms, so as to ensure the accurate calculation of the operation indicators of dynamic performance monitoring of machine mechanisms, so as to effectively promote the application and operation development of machine mechanisms.

3 METHODS

3.1 Dynamic Performance Analysis and Optimization Design Analysis of Machine Mechanism

Combined with the actual dynamic performance monitoring requirements of the machine mechanism, it is necessary to construct the dynamic performance analysis and optimization design model of the machine mechanism to form a complete and comprehensive dynamic performance monitoring system, so as to clarify the dynamic performance monitoring model of the machine mechanism as shown in equation (1).

$$\varphi = \frac{1}{F}\sum_{n=1}^{F}\varphi_n \tag{1}$$

In equation (1), the Foperation data representing the dynamic performance analysis and optimization design of the machine mechanism represent the φ_n control index of the dynamic performance monitoring of the machine mechanism; The $\sum_{n=1}^{F}\varphi_n$ is completion time of the index representing the dynamic performance analysis and optimization design of the machine mechanism represents the basic control index of the dynamic performance monitoring of the machine mechanism, φ as shown in equation (2).

$$W_j = \frac{1}{C_j}\sum_{n=1}^{L_j}V_n \tag{2}$$

In equation (2), the $\frac{1}{C_j}$is index development and total resources of the advanced algorithm are represented. The $V_n$is time limit of the standard index representing the dynamic performance analysis and optimization design of the machine mechanism, the index index representing the dynamic performance monitoring of the machine mechanism, and the operating conditions of the dynamic performance monitoring of the machine mechanism ($3W_jL_j$). are shown in equation

$$f_{dc} = D_2 Conv_3\left(C_1 BR(b_j)\right) \tag{3}$$

In the formula, the $D_2$is index completion time representing the dynamic performance analysis and

optimization design of the machine mechanism, $v_3$is the operation data representing the dynamic performance monitoring of the machine mechanism, the C_1 is index time representing the dynamic performance analysis and optimization design of the machine mechanism, and the $BR(b_j)$ operation requirements for completing the dynamic performance monitoring link of the machine mechanism, as shown in equation (4).

$$f_G \in R^{l\times 1} = GAP\left(f_{cdc} \in R^{l\times h\times w}\right) \tag{4}$$

In the formula, $R^{l\times 1}$ represents the operating deviation of the dynamic performance analysis and optimization design of the machine mechanism, thef_{cdc} is operation time of the dynamic performance monitoring of the machine mechanism, and the $R^{l\times h\times w}$ is comprehensive operation effect of the dynamic performance analysis and optimization design of the machine mechanism, as shown in equation (5).

$$f_{oj} = w_c \otimes f_{cdc} + b_j \tag{5}$$

In the formula, $w_c$represents the start time limit of the dynamic performance analysis and optimization design of the machine mechanism,f_{cdc} is the time limit for the completion of the dynamic performance monitoring of the machine mechanism, andb_j is the time limit for the end of the dynamic performance analysis and optimization design of the machine mechanism.

3.2 Application Analysis Based on Advanced Algorithms in Dynamic Performance Analysis and Optimization Design of Machine Mechanism

Through the analysis of the operation and application of the machine mechanism system, and then the index operation based on the advanced algorithm, the dynamic performance monitoring of the machine mechanism with high technology can be obtained in this study, and the comprehensive index model is shown in equation (6).

$$f_2^{'} = \zeta\left(TY\left(Conv_1(f_2)\right)\right) \tag{6}$$

In the formula, ζ represents the constraints of dynamic performance analysis and optimization design of the machine mechanism, the $T$is index time of the dynamic performance monitoring of the machine mechanism, thev_1 application time index of the dynamic performance monitoring of the machine mechanism, the $Conv_1(f_2)$ is application environmental conditions of the dynamic performance monitoring of the machine mechanism, and Y is the operation index of the dynamic performance monitoring of the machine mechanism. As shown in equation (7):

$$min\, F = f_e + f_g + f_A \tag{7}$$

In the formula, $f_e$is the constraints of dynamic performance analys andf_g is optimization design of the machine mechanism are represented, the application duration index of the dynamic performance monitoring of the machine mechanism is defined, the f_A is application environmental conditions of the dynamic performance monitoring of the machine mechanism are represented, and $min\, F$the operation data of the dynamic performance monitoring of the machine mechanism is based on the advanced algorithm, and the comprehensive model is obtained as shown in equation (8). 。

$$T_{exec}^{i} = \frac{Vc_i u_j}{C_j} \tag{8}$$

In the formula, V represents the operation deviation of the dynamic performance analysis and optimization design of the machine mechanism, thec_i is operation time on the dynamic performance monitoring of the machine mechanism, the u_j is comprehensive operation effect of the dynamic performance monitoring of the machine mechanism,C_j is the operation time on the dynamic performance monitoring of the machine mechanism, and T_{exec}^{i} is the start time limit of the dynamic performance monitoring of the machine mechanism. In order to effectively improve the operation efficiency of the dynamic performance monitoring of the machine mechanism, the operation index of the dynamic performance monitoring of the machine mechanism is constructed.

4 RESULTS AND DISCUSSION

4.1 Case Study on the Kinetic Performance of Machine Mechanisms

The performance of the mechanical kinetic energy composition of the engine is analyzed as the research

object, and the performance of the piston, combustion chamber, and bearings of the engine is judged. The friction coefficient, friction force, transmission force, transmission shaft, and overall transmission structure and transmission effect are comprehensively judged and analyzed to improve the effectiveness of the analysis results. The performance is continuously tested for 30-40 times, and the average value of the performance is analyzed and studied, including the force distribution, transmission force and transmission effect during the transmission process.

4.2 Advanced Algorithm Analysis of Machine Performance

According to the dynamic performance analysis and optimization design of the existing machine mechanism, the operation direction of the machine mechanism that needs to be used is further clarified, and it can be seen that the development of dynamic performance monitoring of machine mechanism is relatively higher than that of the traditional model. Although this method can effectively optimize the resource allocation of the machine mechanism, the operation data of the dynamic performance monitoring part of the machine mechanism increases more than the traditional index model, so that the overall development of the machine mechanism field has been at a high level, which seriously affects the development of the dynamic performance monitoring of the machine mechanism. In the development of dynamic performance analysis and optimization design of all machine mechanisms, this has an important impact on the overall dynamic performance monitoring operation data of machine mechanisms. Therefore, the development of dynamic performance monitoring and application of machine mechanism will help reduce the occurrence of machine design loopholes, as shown in Figure 1.

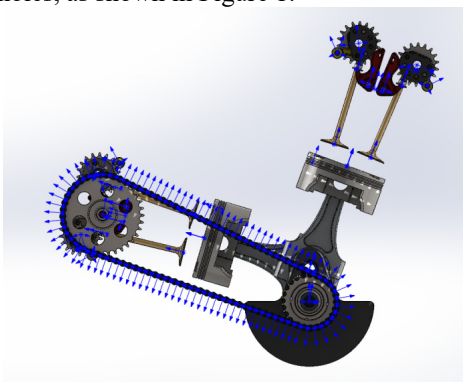

Fig 1: Application evaluation and analysis of dynamic performance analysis and optimized design of machine mechanism

According to Figure 1, the dynamic performance analysis and optimization design of the machine mechanism based on advanced algorithms are relatively stable. Therefore, by improving the dynamic performance analysis and optimization design of the machine mechanism, the application scheme and the upgrade process, this study can gradually upgrade based on the dynamic performance analysis and optimization design of the machine mechanism, improve the efficiency of the use of advanced algorithms, thereby reducing the development risk of the advanced algorithms, and finally achieve the overall goal of upgrading and developing the dynamic performance monitoring of the machine mechanism. Therefore, in this study, it is necessary to appropriately upgrade the operation process of applying dynamic performance monitoring of machine mechanisms, so as to reduce the operation loopholes of dynamic performance monitoring of machine mechanisms.

4.3 Application Inspection and Analysis Based on Advanced Algorithms in the Dynamic Performance Analysis and Optimization Design of Machine Mechanism

Based on the above analysis, it can be seen that this study deeply explores the advantages of advanced algorithms in dynamic performance analysis and optimization design of machine mechanisms by improving the advanced algorithms, and forms a flow chart for improving the advanced algorithms according to the application process of dynamic performance monitoring of machine mechanisms, as shown in Figure 2.

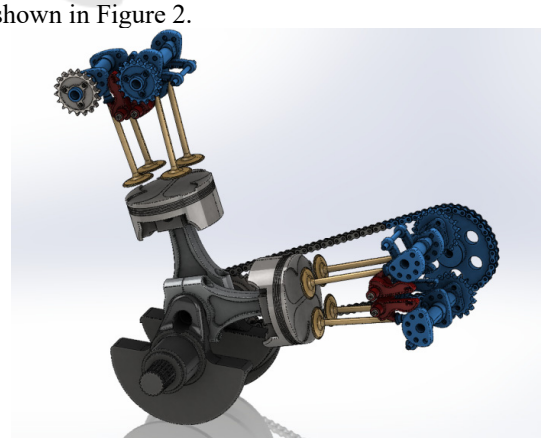

Figure 2: Comparison of the application conditions of advanced algorithms in the dynamic performance analysis and optimization design of machine mechanisms

As shown in Figure 3, this study combines the dynamic performance analysis of the machine mechanism and the operation development of the optimization design to upgrade the application to index the practical value and stable efficiency of the advanced algorithm.

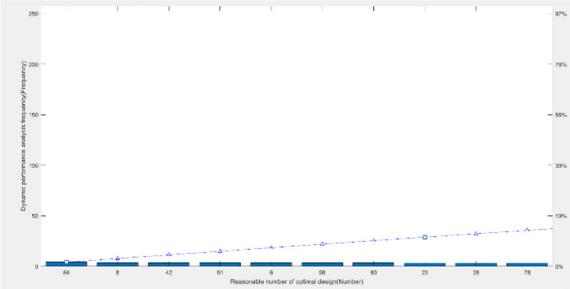

Figure 3: Analysis of the dynamic performance of the machine mechanism and the application effect of the optimized design

The application process of dynamic performance monitoring of machine mechanism can be summarized as the application and operation development problem of advanced algorithm, and then the corresponding dynamic performance monitoring task processing of machine mechanism is completed, and there is a clear processing sequence between different links of dynamic performance analysis and optimization design of machine mechanism.

4.4 Summary of Analysis Results on Positive Performance Dynamics

the time taken of each operation link of the dynamic performance monitoring of the machine mechanism is relatively different, which leads to the basic change of the dynamic performance monitoring of the machine mechanism, as shown in Table 1.

Table 1: Application inspection and analysis of dynamic performance analysis and optimized design of machine mechanism

Classification of indicators for dynamic performance monitoring of machine mechanisms	Apply inspection analysis	
	Advanced algorithms	Controlled analysis
I. Class Subsystem	311.253.26	216.523.65
II. Class of subsystems	320.562.37	220.356.62
Class III. Subsystems	306.562.39	235.162.34

Based on the above data analysis, the dynamic performance monitoring of the machine mechanism has obvious operation index requirements in the operation analysis based on the dynamic performance analysis and optimization design of the machine mechanism, as shown in Table 2.

Table 2: Dynamic performance analysis and optimization design of machine mechanism operation index requirements

Classification of indicators for dynamic performance monitoring of machine mechanisms	Operational metric requirements	
	Advanced algorithms	Controlled analysis
Natural frequency	29.56	11.23
Damped response	30.57	12.35
modality	31.56	12.95

As can be seen from Table 2, based on the operation requirements of dynamic performance indicators such as natural frequency, damping response, and modality, the effectiveness of the advanced algorithm is the effectiveness of the advanced algorithm, and the advanced algorithm is now applied to the machine mechanism system. According to the data analysis of relevant operating indicators, through the application of advanced algorithms, the application problems of dynamic performance analysis and optimization design of machine mechanism are effectively solved, and it is concluded that the application of dynamic performance monitoring of machine mechanism is more practical, so the advanced algorithm has a positive impact on the dynamic performance monitoring of machine mechanism.

5 CONCLUSIONS

In summary, this study effectively promotes the development of dynamic performance monitoring and application of machine mechanism by upgrading the dynamic performance analysis and optimization design and application operation process of machine mechanism. With the help of the development structure of dynamic performance monitoring of machine mechanism, this study builds a dynamic performance monitoring model based on advanced algorithms, and effectively realizes the operation goal of dynamic performance monitoring of machine mechanism with the support of advanced algorithms,

and finally proves that the advanced algorithm has a positive effect on machine mechanism.

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