An Image Recognition Algorithm for Estimating the Influence of Bending Moment on the Stress of the Bolts Connecting the Double Flange Turbine Head Cover and the Stay Ring

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Abstract: In the double flanged head cover, besides the preload, and bending moment due to the water pressure, the connecting bolts take additional bending moment after pre-stressed due to it's own asymmetrical supported structure. The additional bending moment further increased the equivalent stresses in the bolt and therefore shall be included in the calculation. In order to solve the challenge of bending moment estimation stay ring, in view of the shortcomings of the existing divide and conquer algorithms, an innovative stress influence method of the double flange turbine head cover and stay ring connection bolts based on image recognition algorithm is proposed. This new approach uses the principles of pattern recognition theory to accurately identify and locate key influencing factors, and accordingly performs a sensible classification of indicators to reduce possible interference. At the same time, using the unique mechanism of image recognition algorithm, the design strategy of stress influence is cleverly constructed. The empirical results show that the scheme shows a significant improvement compared with the traditional divide-conquering algorithm in the key performance indicators such as the accuracy of the stress influence of the bolts connecting the double-flange turbine head cover and the stay ring, and the processing efficiency of key factors, showing its obvious strong advantages. In bending moment estimation, the stress influence of the bolts connecting the double flange turbine head cover and the stay ring plays a crucial role, which can accurately predict and optimize the growth trend and output results of the influence of the bending moment estimation on the stress of the bolts connecting the double flange turbine head cover and the stay ring. However, in the face of complex simulation tasks, traditional divide-and-conquer algorithms show some inherent shortcomings, especially when dealing with multi-level challenges, their performance is often unsatisfactory. To overcome this, this study introduces a new idea of the stress influence of the bolts connecting the double-flange turbine head cover and the stay ring optimized by the image recognition algorithm, and accurately controls the influencing parameters through the pattern recognition theory, and uses it as the road map for index allocation, and then uses the image recognition algorithm to innovate and construct the system scheme. The test results clearly point out that in the context of the evaluation criteria, the new scheme has been significantly optimized in terms of accuracy and processing speed for a variety of challenges, showing stronger performance superiority. Therefore, in the influence of bending moment estimation on the stress of the bolts connecting the double flange turbine head cover and the stay ring, the simulation scheme based on the image recognition algorithm successfully overcomes the shortcomings of the traditional divide and conquer algorithm, and significantly improves the accuracy and operation efficiency of the simulation.

1 INTRODUCTION

The importance of bolt stress influence in bending moment estimation is self-evident when connecting the double flange turbine head cover and the stay ring. Its connection reliability directly affects the safety of the turbine unit and the power station (Yang and Chen et al. 2022). shows a typical structure of bolt

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connection between double flanged head cover and stay ring.

Through simulation, various parameters and changes in this process can be predicted and understood, providing guidance and support for actual production (Wang and Wang, et al. 2023). However, the traditional double-flange turbine head cover and stay ring connection bolt stress influence scheme has certain shortcomings in terms of accuracy, which limits its effect in practical application (Chen and Sun, et al. 2023). In order to solve the accuracy problem of the stress influence of the bolts connecting the traditional double-flange turbine head cover and the stay ring, in recent years, researchers have introduced the image recognition algorithm into the analysis of the stress influence of the bolts connecting the double-flange turbine head cover and the stay ring (Wang and Huang, et al. 2023). Image recognition algorithm is a computational method based on group behavior, which simulates the interaction and cooperation between individuals to achieve the goal of global optimization. The algorithm has the characteristics of decentralization, immutability and smart contract, which can effectively solve the accuracy problems existing in traditional schemes (Sang and Hua, et al. 2023). The optimization model of the stress influence of the bolts connecting the double flange turbine head cover and the stay ring based on the image recognition algorithm further improves the accuracy and reliability of the simulation by optimizing the parameters and algorithms in the process of the stress influence of the bolts connecting the double flange turbine head cover and the stay ring (Xiang and Zhu, 2023). The model adjusts and optimizes the various parameters in this process to achieve the best stress effect. At the same time, the model is able to cope with complex environments and interference factors, providing more realistic and reliable simulation results (Chen, 2023). Through a large number of experiments and data analysis, the researchers evaluated the effectiveness of the optimization model based on image recognition algorithm for the stress effect of bolts connecting double flange turbine head cover and stay ring (Sha and Zeng, et al. 2023). The results show that compared with the traditional double-flange turbine head cover and fixing ring connection bolt stress influence scheme, the proposed model has significant advantages in many aspects (Yu and An, et al. 2023).

2 A THEORETICAL MODEL OF THE STRESS EFFECT OF THE BOLT CONNECTING THE DOUBLE FLANGE TURBINE HEAD COVER AND THE STAY RING IS CONSTRUCTED

The image recognition algorithm uses computer technology to improve the stress influence strategy of the bolts connecting the double flange turbine head cover and the stay ring, and analyzes is W_i a series of key parameters involved in the system research to identify the parameter values that do not meet the standard in the study. Subsequently, the algorithm integrates is E_i these parameter values is $\hat{e}_i = E_i / |E_i|, \hat{h}_i = H_i / |H_i|$ into the stress influence scheme of the bolts connecting the double flange turbine head cover and the stay ring, and then comprehensively evaluates the implementation possibility of the study (Yang Xia and Zhang Meng, et al. 2023). The calculation process can be referred to equations (1) and (2).

$$W_i = \frac{1}{2} E_i \times H_i \left|W_i\right| = \frac{\left|E_i\right|^2}{2\eta_o} \tag{1}$$

$$\mathrm{P} = \sigma \left|W_i\right| = \frac{\sigma}{2\eta_o} \left|E_i\right|^2 \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \tag{2}$$

The image recognition algorithm combines the advantages of computer technology to quantify the stress influence of the bolts connecting the double-flange turbine head cover and the stay ring, which can improve the accuracy of the stress influence of the bolts connecting the double-flange turbine head cover and the stay ring.

The image recognition algorithm implements a global search for the stress influence of the bolts connecting the double flange turbine head cover and the stay ring according to the set number of iterations, and completes an iterative process for each search. Pheromones will be generated during the stress effect of the bolts is E_i connecting the double flange turbine head cover and the stay ring, so the remaining pheromones in the search path need to be updated after each iteration process, and the formula is W_s described as follows:

$$|W_s| = \frac{\mathrm{P}}{4\pi \mathrm{R}^2} = \frac{\sigma |E_i|^2}{8\pi\eta_o R^2} \frac{n!}{r!(n-r)!} \tag{3}$$

In order to avoid falling into the local optimal problem in the target iteration process, the upper limit of pheromone value is E_s set, and the formula is η_o described as follows:

$$|W_s| = \frac{1}{2\eta_o} |E_s|^2 \mathrm{M} \tag{4}$$

From the above, the comprehensive function of the stress effect of the bolt connecting the double flange turbine head cover and the stay ring can be obtained, and the result is shown in equation (5).

$$\sigma = 4\pi R^2 \frac{|E_s|^2}{|E_i|^2} \tag{5}$$

In order to improve the reliability of the stress of the bolts connecting the double flange turbine head cover and the stay ring, all data need to be standardized, and the results is shown in equation (6).

$$\sigma = \lim_{R\to\infty} 4\pi R \frac{E_s \times E_s^*}{E_i \times E_i^*} \sqrt{a^2 + b^2} \tag{6}$$

Before the image recognition algorithm, it is necessary to analyze the stress influence scheme of the bolts connecting the double-flange turbine head cover and the stay ring in all aspects, and map the stress influence requirements of the bolts connecting the double-flange turbine head cover and the stay ring to the resource query system research library, and eliminate the unqualified resource query system research scheme. The anomaly assessment scheme can be proposed, and the results is $No(t_i)$ shown in equation (7).

$$No(t_i) = \frac{g(t_i) + F(d_i)}{mean(\sum v_{ij} + 4)} \frac{n!}{r!(n-r)!} \tag{7}$$

3 PRACTICAL EXAMPLE OF STRESS EFFECT ON BOLTS CONNECTING DOUBLE FLANGE TURBINE HEAD COVER AND STAY RING

3.1 The Relevant Concept of the Stress Influence Model of the Bolt Connection Between the Double Flange Turbine Head Cover and the Stay Ring

The construction of the stress influence model of the double flange turbine head cover and stay ring connection bolt contains several key concepts to ensure that the resulting model can not only comprehensively map the complexity of the stress influence process, but also show sufficient applicability and accuracy. First of all, it involves the thinking of systems theory, which emphasizes the need to take a holistic view of the mathematical, chemical, and physical elements involved in the effects of stress when shaping the model, and to understand how these elements interact and interact with each other from a system perspective to jointly affect the overall process of stress effects. Further, there is the concept of dynamic evolution, which requires the model to be sensitive to revealing time-based dynamics and processes to keep up with the change and growth of activities, given that stress-influenced processes continue to evolve over time. The concept of multi-level modeling reveals that the constructed model should incorporate the scale of change in different fields from macro to micro, from physics and mathematics to process flow, to ensure that the model is compatible and covers different levels of detailed information. The estimation and verification of parameters is a key process to ensure that the stress influence model of the bolts connecting the double flange turbine head cover and the stay ring truly reflects the actual search process, and to determine and fine-tune these parameters through the actual data to ensure that the model results is consistent with the actual observations. The data-driven principle further highlights the central role of observational data in the model building and validation stage, and the collection, processing, and analysis of data constitute an indispensable part of building accurate models. Furthermore, considering that different stress scenarios and different bending moment estimation paths may require different model configurations, the scalability of the model is particularly critical, which means that the model should be designed to be easy to change and add new components to adapt to the changing stress environment and requirements.

Based on the above concepts, the construction of a stress influence model of double-flange turbine head cover and stay ring connection bolts requires not only thorough scientific insight into multidisciplinary processes, but also extensive system analysis perspectives, strong data processing technology, and future-oriented open thinking. Many elements work together to create a simulation model of the bending moment estimation process that is both accurate and widely applicable.

Simulate the stress effect process of the bolt connecting the double flange turbine head cover and the stay ring, as shown in Figure I.

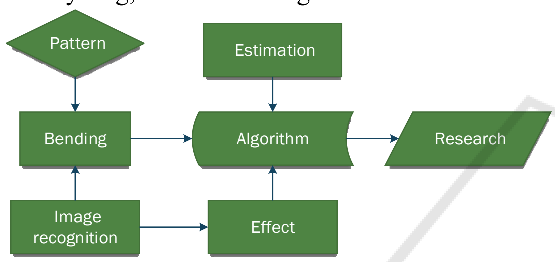

Figure 2: Analysis process of the stress effect of bolts connecting double flange turbine head cover and stay ring

Compared with the divide and conquer algorithm, the image recognition algorithm is introduced into the stress influence of the bolts connecting the double flange turbine head cover and the stay ring, which brings a lot of innovation to solve the practical problems. As a critical step in processing natural language, accuracy is critical in understanding and processing natural data in search. This algorithm can better deal with the complexity of the semantic and syntactic levels in the stress effect, so the image recognition algorithm shows its inherent advantages compared with the traditional divide and conquer algorithm in the rationality and accuracy of the stress influence of the double-flange turbine head cover and the stay ring connection bolt. As shown in Figure II, the change in the stress influence scheme of the bolts connecting the double flange turbine head cover and the stay ring shows that the search results can be obtained with higher accuracy by using the image recognition algorithm, because the image recognition algorithm more accurately parses the keywords and structures in the user's search intent and achieves more detailed information matching. compared with divide-and-conquer algorithms, which often rely on preset rules and paths, image recognition algorithms can process data more flexibly in the face of complex searches, reducing misunderstandings and ambiguities.

In terms of search speed, although the divide and conquer algorithm searches quickly when the structure is clear, the image recognition algorithm can also achieve fast and effective search feedback by optimizing the cutting and matching process of words, especially in the face of large-scale thesaurus and dynamically updated search resources, the image recognition algorithm can maintain efficient search ability. In terms of stability, image recognition algorithms can cope with changing search environments and usage patterns through continuous Xi learning and self-optimization, so as to provide a stable search experience. However, due to the lack of a learning Xi mechanism, the divide and conquer algorithm may need to be redesigned and adjusted once it encounters a change in search mode or a new data type, which is slightly inferior in terms of stability. In practical applications, image recognition algorithms can be combined with other advanced machine Xi techniques, such as depth Xi, semantic understanding, etc., to further improve the overall performance and user experience of the stress effects of the bolts connecting the double flange turbine head cover and the stay ring. As for the divide and conquer algorithm, although it still has its unique application scenarios in the search task with clear rules and fixed rules, it is obvious that the image recognition algorithm provides a more advanced and adaptable solution in the stress effect of the bolts connecting the modern double-flange turbine head cover and the stay ring.

3.2 Stress Influence of Double Flange Turbine Head Cover and Fixing Ring Connection Bolts

When developing a design for a stress-affected system, it is important to note that the scheme should cover all types of data. We categorize this data into unstructured, semi-structured, and structured information, each with its own characteristics and methods of storage, processing, and analysis. Using efficient image recognition algorithms, we were able to perform an efficient preliminary screening of these diverse data types to obtain a preliminary selected set of stress effects on the bolts connecting the double flange turbine head cover and the stay ring. After screening by the image recognition algorithm, we obtained a series of potential stress influence schemes for the bolts connecting the double flange turbine head cover and the fixing ring. We then go further and analyze the practical feasibility of these options in detail. This step is crucial because it helps us identify those that can be implemented effectively in the real world, as well as those that may be theoretically feasible but difficult to apply in practice. In order to more comprehensively verify the effectiveness of the stress influence schemes of different double-barrelled turbine head cover and retainer ring connection bolts, we must com pis several different levels of stress influence schemes of double flange turbine head cover and stay ring connection bolts. These options must be rigorously selected and compared to ensure that they cover design strategies from basic to advanced. In this way, we can create a more detailed comparison framework, as shown in the table below (Table I.), which details the features, advantages, and performance of each design solution under different conditions, so that we can make the most reasonable choice accordingly.

Table 1: Subject-related parameters of the study

Category	Random data	Reliability	Analysis rate	Compatibility
Double flange connection	87.53	90.95	92.44	90.99
Bending moment estimation	91.29	92.09	91.24	91.04
Strength verification	92.38	88.34	90.13	89.92
Stability verification	89.64	89.61	85.24	86.59
Mean	92.55	93.10	93.28	86.54
X6	89.99	88.43	89.79	90.09

3.3 Stress Influence and Stability of Bolts Connecting Double Flange Turbine Head Cover and Stay Ring

The stability of the stress effects of the bolts on the double fanged turbine head cover and the stay ring connection is a key factor in ensuring the long-term effective operation of the system and providing reliable service. A stable stress-affected system is able to consistently deliver high-quality search results in the face of varying search loads, changes in user behavior, and data updates, without drastic performance degradation or service interruption due to external changes.

Stability Affects Several aspects of the stress of the bolts connecting the double flange turbine head cover and the stay ring include: The stress of the bolts connecting the double flange turbine head cover and the stay ring affects the robustness of the system architecture: A strong system architecture is the basis for ensuring stability. This typically involves redundant design, fault-tolerant mechanisms, and highly available hardwired and softwoods resources to prevent a single point of failure that could lead to the collapse of the entire system. Stress on bolts connecting double fanged turbine head cover to stay ring affects the accuracy of data processing: Stress effects systems need to process and analyze data accurately to ensure reliable search results. This requires the algorithm logic to be able to handle a variety of boundary conditions and anomalies, and to maintain consistency in the results when the data is updated or the structure changes. The stress of the bolts connecting the double fanged turbine head cover and the retainer ring affects the consistency of the search efficiency: the efficiency of the system should be consistent when handling searches of all sizes. Whether it's a small amount of data searching or a large batch of data processing, the system should provide stable response times to avoid performance degradation under high loads. Stress on bolts connecting double flange turbine head cover and stay ring affects anti-interference ability: A stable stress influence system should be able to adapt to the influence of external interference factors such as network fluctuations and system load changes to avoid service interruption or failure. Stress on the bolts connecting the double fanged turbine head cover and the retainer ring affects the scalability and adaptability: as resources increase and technology evolves, the system should be able to flexibly expand and adapt to new search needs and data types to ensure a stable service delivery.

Achieving stress affecting the stability of the system typically requires the following strategies: Stress on the bolts connecting the double flange turbine head cover and the stat ring affects continuous performance monitoring: real-time monitoring of system performance and user behavior in order to identify potential problems and make adjustments in time. The stress of the bolts connecting the double flange turbine head cover and the stay ring affects the load balancing: the reasonable distribution of system resources and search for load can improve the compressive ability and stability of the system. Stress on the bolts connecting the double flange turbine head cover and the stay ring affects the regular maintenance and update: the system is regularly maintained and updated to fix known problems and enhance the stability of the system. Optimization algorithm and data structure of bolt stress influence of double flange turbine head cover and stay ring connection: Optimize the underlying algorithm and data structure to improve the computing efficiency of the system and the ability to stably handle a large number of concurrent searches. Stress effects on the bolts connecting the double flanged turbine head cover and stay ring create a detailed disaster recovery plan to ensure that the system can recover quickly after a major failure. The stress of the bolts connecting the double flange turbine head cover and the stay ring affects user feedback and system iteration: actively collect user feedback, continuously iterate and update the system, and improve stability and satisfaction. Through these measures, the stress effect of the bolts connecting the double fanged turbine head cover and the stay ring is intended to create a stable service platform that can adapt to real-world needs and respond quickly to future changes. In order to verify the accuracy of the image recognition algorithm, the stress influence scheme of the bolts connecting the double flange turbine head cover and the stay ring is compared with the divide and conquer algorithm, and the stress influence scheme of the bolts connecting the double flange turbine head cover and the stay ring is shown in Figure 3.

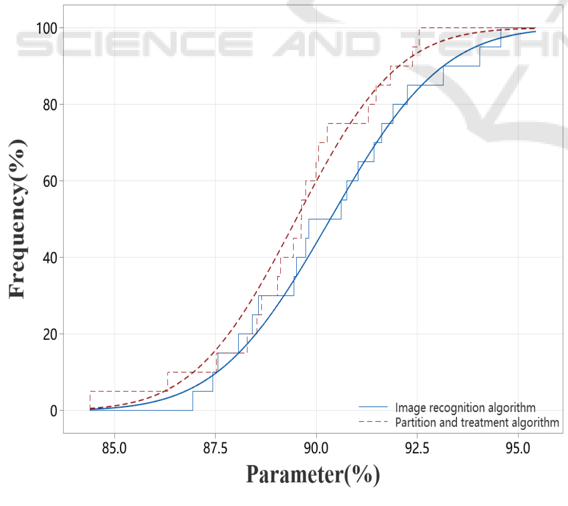

Figure 2: Effect of stress on bolts connecting double flange turbine head cover and fixing ring with different algorithms

By looking at the comparison of the data and the graph in Figure 2, we can clearly see that the image recognition algorithm surpasses the divide and conquer algorithm in the execution of the stress effect of the bolts connecting the double flange turbine head cover and the stay ring, and its error rate is relatively low. This low error rate points to an important conclusion, that is, the image recognition algorithm is applied to the stress effect of the bolts connecting the double flange turbine head cover and the stay ring, which brings a relatively stable and reliable performance. On the contrary, although the divide and conquer algorithm also has its application in the stress influence of the bolts connecting the double flange turbine head cover and the stay ring, the results fluctuate greatly, resulting in the inconsistency of the overall performance. This fluctuation may be due to the limitations and challenges that divide and conquer algorithms may face when dealing with complex and variable stress-affected tasks. In other words, the divide and conquer algorithm shows an uneven effect in the stress effect of the bolts connecting the double flange turbine head cover and the stay ring, which reduces its application value and reliability in this regard to a certain extent. In summary, the stability and low error rate of the image recognition algorithm show its superiority in the field of stress influence of bolts connecting double flange turbine head cover and stay ring, while the divide and conquer algorithm shows limitations in such applications. Therefore, when seeking a high-efficiency and stable dual-flange turbine head cover and stay ring connection bolt stress influence scheme, the image recognition algorithm may be a more reasonable choice.

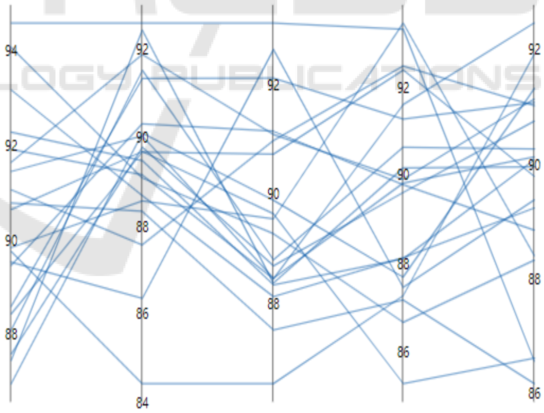

Figure 3: Effect of bolt stress on double flange turbine head cover and fixing ring connection of image recognition algorithm

Figure 3 shows the experimental results of using the image recognition algorithm to obtain better performance than the divide and conquer algorithm in the stress effect of the bolts connecting the double flange turbine head cover and the stay ring. There may be several key factors that make image recognition algorithms perform well: Introduction of adjustment coefficients: In the simulation of stress-influenced processes, image recognition algorithms may introduce adjustment coefficients to adjust the parameters in the simulation process in more detail. These coefficients may be closely related to the specific operating conditions or reactor design in the lab, allowing the algorithm to more accurately reflect and optimize real-world processes. Threshold setting and scheme filtering: By setting thresholds for acquired Internet information, an image recognition algorithm may retain only those that meet the set criteria among multiple candidates. This means that the algorithm is able to automatically reject simulation results that may be based on misinformation or unreliable data, ensuring the quality of the optimization process. Balance between exploration and utilization of swarm algorithm: It maintains a good balance between exploring and finding new solutions and optimizing known solutions by exploiting them. This allows the algorithm to avoid premature convergence to the local optimal solution while maintaining efficient optimization, and to explore a wider solution space.

On the other hand, the poor performance of divide and conquer algorithms in this context may be related to some of their inherent limitations: Over fitting: Decision trees may tend to complicate and, in some cases, over fit the training data, resulting in insufficient generalization capabilities for new data. Select the local optimal solution: The decision tree is split at each node only considering the local optimal attributes, which may not capture the global optimal parameter configuration of the complex stress influence process.

The image recognition algorithm searches and optimizes multiple solutions in parallel, and continuously uses the information sharing among group members to guide the search process, so it can find the global optimal or approximate global optimal solution compared with a single divide and conquer algorithm when dealing with the complex stress influence scenario of the bolt connection between the double-flange turbine head cover and the stay ring. The robustness and adaptability of this algorithm make it an indispensable tool in fields such as bioengineering and industrial process optimization.

It is evident from Figure 4 that the stress effect of the bolts connecting the double-barrelled turbine head cover and the fixing ring using the image recognition algorithm far exceeds the design with the divide and conquer algorithm in terms of performance. This significant gap is mainly due to the fact that the image recognition algorithm introduces a special adjustment factor in the process of stress influence of

Table 2: Rationalization and comparison of the stress influence of double flange turbine head cover and stay ring connection bolts of different methods

Algorithm	Adjustment factor	Threshold settings	Scenario screening	Explore
Image recognition algorithms	87.56	89.74	88.66	89.58
Divide and conquer algorithm	89.74	84.39	86.50	87.23
P	86.94	90.06	89.86	87.66
X	91.62	91.83	91.06	89.88

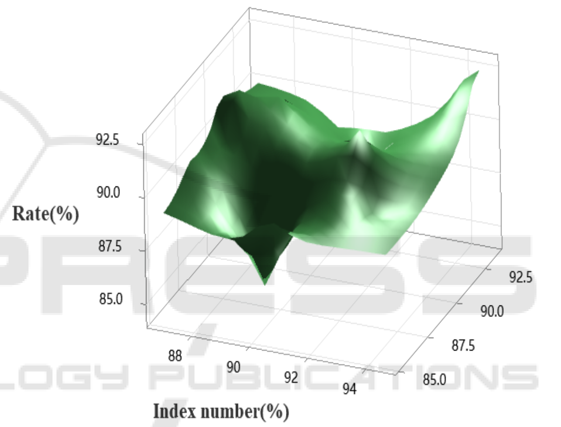

Figure 4: Comparative study of the research scheme of the algorithm

the bolts connected to the double flange turbine head cover and stay ring. The introduction of this coefficient enhances the flexibility and adaptability of the algorithm, allowing it to better adjust the strategy according to different situations. In addition, the image recognition algorithm sets a specific threshold for Internet information processing. With this threshold, the algorithm is able to effectively identify and exclude stress effects on the bolts of the double flange turbine head cover and stay ring that do not meet the predetermined criteria. This intelligent filtering mechanism makes the image recognition algorithm more efficient when processing a large number of candidates, ensuring that only the most suitable solutions is selected to continue to participate in the further design and evaluation phases. Combining these two innovations, namely the introduction of adjustment coefficients to improve the control ability of the algorithm, and the setting of information thresholds to accurately screen the design solutions that meet the standards, the image recognition algorithm makes the stress influence process of the bolts connecting the double flange turbine head cover and the stay ring more efficient, and the output design scheme is more high-quality. These improvements finally form the core advantage of the proposed algorithm over the divide and conquer algorithm in the problem of stress influence of bolts connecting double flange turbine head cover and stay ring.

4 CONCLUSIONS

In order to solve the accuracy problem of the stress influence of the bolts connecting the double flange turbine head cover and the stay ring, a new comprehensive optimization scheme was proposed, which was based on image recognition algorithm and advanced computer technology. Initially, the security of information and the credibility of tampering with it were ensured by using the decentralized characteristics of image recognition algorithms and their data consistency assurance. Then, combined with computer technology, the collected data is deeply analyzed and processed in detail, so as to dig out the intrinsic attributes and potential value of the data. This study also delves into the key performance indicators required to ensure that the stress effects of the double flange turbine head cover and stay ring connection bolts is accurate and credible, and constructs a comprehensive network information collection platform that plays a crucial role in ensuring the accuracy of the research output. However, it is worth noting that when applying the image recognition algorithm, it is necessary to be cautious in the selection of the stress influence evaluation system of the bolt connecting the double flange turbine head cover and the stay ring, so as to effectively explore and use the advantages of the image recognition algorithm and further improve the accuracy and practical application value of the research results.

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