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Research on Structural Analysis Method of Long-span Steel Structure Construction Process Based on Feature Extraction Algorithm

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Abstract: The construction of long-span steel structure is a continuous process, and the stress state of its structure changes. Modern construction projects tend to be more and more high-rise buildings, because the span and height of construction projects are small at the early stage of development of construction industry, and the stress of building structures is not large compared with high-rise and large-span buildings, so the situation of components after construction is roughly the same as that before construction. Image mosaic technology is an important branch of image processing technology. Its significance is to use small image acquisition equipment to obtain large and high-definition images through software splicing. On the one hand, more and more complete information can be obtained on an image through splicing. On the other hand, the cost of small equipment is much lower than that of large equipment, which can greatly reduce the cost. Combined with feature extraction algorithm, this paper expounds the structural analysis method of long-span steel structure construction process.

1. Introduction

In recent years, with the continuous development of China's socialist economic strength, the national construction industry has also developed rapidly. Among them, due to the excellent construction characteristics of long-span steel structure, the development trend of long-span steel structure is becoming more and more superior now and in the future. It is preliminarily estimated that it will replace cast-in-place reinforced concrete structure in the future [1]. The construction of long-span steel structure is a continuous process, and the stress state of the structure has a changing process. Modern construction engineering is more and more inclined to high-rise buildings. In the early stage of the development of the construction industry, the span and height of the construction engineering are small, and the stress of the building structure is small compared with the high-rise long-span buildings. Therefore, the situation of components after construction is roughly the same as that before construction [2]. In the design of building structure, if designers don't attach great importance to various factors affecting the performance of building structure, it will not affect small-span or low-rise buildings, but it will bring many influences to large-span and high-rise buildings [3].

After the steel structure is constructed in the last stage, its structural internal force and displacement will have a certain impact on the internal force and displacement in the next stage. Therefore, in the construction of long-span steel structure, the internal force and displacement of each stage should be tracked and calculated, so as to obtain the accurate cumulative effect of structural internal force and structural displacement [4-5]. Flatness control has become an urgent problem to be solved in today's metallurgical industry, and flatness detection is one of the important prerequisites for realizing flatness automatic control. The long-span steel structure is different. Due to the large stress in the construction process, some members of the long-span steel structure will deform during the construction process. Although these deformations can be predicted before the construction, if the construction process is not controlled, the steel structure after the construction may not be completely consistent with the design, this is also one of the factors causing structural instability [6-7]. The steel plate shape image mosaic technology studied in this paper is one of the key technologies in the linear laser shape detection system. Image mosaic technology is an important branch of image processing technology. Its significance lies in using small image acquisition equipment to obtain large and high-definition images through software mosaic. On the one hand, more and more complete information can be obtained on an image through mosaic; on the other hand, the cost of small equipment is much lower than that of large equipment, which can greatly reduce the cost. In the actual construction of long-span steel structure, not only the strict construction organization design but also the rigorous analysis of the stress characteristics of the structure are needed [8]. It is of great significance and far-reaching influence on the research work of structural feature extraction algorithm in the construction process of long-span steel structures [9]. In recent years, the domestic steel prices have soared, driven by interests, and the low-level redundant construction in the domestic steel industry is very serious, which leads to a knotty surplus in domestic steel production, and steel enterprises are generally facing tremendous pressure to survive. In the construction process of long-span steel structure, intelligent inspection technology has been widely concerned, especially computer vision inspection technology, which has become a very important method in the detection technology of width, length, fore and aft contour and straightness of steel plate [10]. Therefore, this paper proposes a new feature extraction method of autocorrelation function, which combines the extracted autocorrelation function features with sample data to form a new sample, and studies the training and classification performance of the new sample data.

2. Construction mechanics of long span steel structure

2.1 Principle of construction mechanics of large span steel structure

In recent years, the construction of long-span structures is becoming more and more common, which is the inevitable requirement of the development of the construction industry. However, the construction of long-span structures is difficult. According to the construction experience, the construction of long-span steel structure is a continuous and complex construction process. In the construction process of long-span steel structure, its stress characteristics have been changing with the increase of structural members. Due to the large span of the long-span structure, it is impossible to carry out the overall construction, so the long-span construction is not only a phased process, but also a continuous process. "Phased" means that the construction of the long-span structure should be carried out in sections, and "continuity" means that each stage of the long-span structure should be constructed continuously. The calculation of construction structure is to ensure the feasibility and scientificity of the construction scheme on the basis of taking the structural design standard as an important basis, so as to improve the construction stability and safety. Due to the large span, the steel structure will have weak deformation before and after connection, and these deformation will not only affect the connection of the steel structure, but also affect the stress of the whole structure.

According to the specific situation of building construction, it can be seen that some supporting systems need to be added during the construction process of the structure, which is only temporary, so as to study and analyze the structure during the construction process when it is integrated with the original structure. In the process of construction, the change of temperature, the increase of components and the change of live load will all have an impact on the prestress analysis of the structure. Therefore, it is necessary to be familiar with the change characteristics of the prestress state of the structure during the analysis to ensure the accuracy of the structural mechanics principle analysis.

2.2 Construction characteristics of long-span steel structure

Because the rigidity of steel structure is larger than that of river, it can be regarded as a rigid structure, and the rigid structure has smaller deformation under the same load because of its higher rigidity, so we can consider these linear deformations from the viewpoint of linear theory and solve the structural mechanics equation in linear state. For the whole long-span steel structure, it avoids the influence of external load through deformation, and this theory plays a very important role in structural analysis. Based on the above analysis, rigid structure, semi-rigid structure and flexible structure have their own characteristics, and there are also great differences in stress. Usually, the stiffness of long-span steel structures is relatively strong, so the probability of deformation is relatively small. Therefore, if deformation occurs, it can be analyzed through the relevant knowledge of linear theory, so as to solve the mechanical equations. With the rapid development of the construction industry, large-scale building structure has become the inevitable trend of building development in the future, and the construction of large-scale structure has become the top priority of modern building construction. Cable net, membrane structure and cable membrane hybrid structure belong to flexible structures. The flexural and shear stiffness of the components is weak. The distribution of tensile force determines the geometric configuration of the structure. At this time, there is often a geometric configuration with minimum potential energy. There are also some differences in the structural stress analysis methods in the construction process. The structural construction mechanics analysis method in the construction process plays a considerable role in the construction and development of large components composed of these structures. According to the content of the above theory, the structure needs to bear through great deformation in order to avoid being subjected to strong load. With the more and more extensive application of long-span steel, when analyzing the construction structure, designers must apply the analysis method to the actual work in combination with the characteristics of construction and structure, so as to make the designed structure more stable, so as to ensure the construction quality and construction safety.

3. Database and feature extraction

3.1 Database

The remote sensing image database of UCI machine learning database is used in the experiment. Each sample of this database is composed of remote sensing data in 4 bands and 3*3 image areas. The category of samples is determined by the pixel located in the center of the area, and the category of samples is represented by numbers. There are 4,435 training samples and 2,000 test samples in this database, and each sample has 36 feature attributes, which are remote sensing data of these 9 pixels in 4 bands. The support vector machine uses the LIBSVM software package developed by Professor Lin Zhiren to train and classify the sample data. Table is the number of samples of each category of the database.

Table 1: Number of samples of each category in the database

Category	Training sample/piece	Test samples/pieces.
C1	1073	460
C2	478	223
C3	960	396
C4	414	210
C5	469	236
C6	1037	469

3.2 Feature extraction algorithm

Different from the traditional feature extraction algorithm, all the data are processed in a unified way. The algorithm is based on the local relation features of the data, and only uses the data points in the local neighborhood to construct the overall structural relationship of the data. When using the improved algorithm for structural analysis, it is necessary to obtain the low-dimensional projection of the data according to the data model of the long-span steel structure construction process. The shape image of the steel plate is acquired by a camera, and the images are continuously acquired during the moving process of the steel plate. In this way, the brightness and even the width of laser lines in the overlapping area of two adjacent images are different. Before feature extraction, the stitching position is determined by comparing the gray value of the matching template. Unify the search area, with 144 rows and 40 columns in the column direction. The time used by each algorithm is shown in the table. The fastest algorithm is the ratio matching method.

Table 2: Comparison of stitching algorithms before feature extraction

Algorithm	Splicing one	Splicing two	Splicing three	Splicing four	Splicing five	Splicing six	Time (seconds)
Block matching algorithm	Good	Good	Good	Better	Better	Good	1.6101
Ratio matching algorithm	Good	Good	Good	Better	Be poor	Better	0.6872
Difference matching algorithm	Good	Good	Good	Better	Better	Good	1.0632

It can be seen from the previous analysis that in the process of modeling using local data features, based on the connectivity between neighborhood sets, the global information of data is essentially obtained. If the stitching fails due to noise interference, it needs to filter the noise, and the median filter needs to be used to filter the noise in the gray image, which consumes more time than the mathematical morphology method. In the modeling stage, the transformation matrix between the original space and the projection space is provided, so the low-dimensional projection of the data can be obtained directly based on the projection matrix without recalculating the neighboring points of the test data.

4. Conclusions

To sum up, according to some problems in the actual construction of long-span steel structure, this paper briefly analyzes the construction mechanics principles and methods of long-span spatial steel structure and several common installation methods of long-span spatial steel structure. Analyzing the construction process of long-span steel structure from the perspective of construction mechanics is of great significance in various construction projects. It can not only improve the construction stability

of long-span structure, but also greatly improve its construction safety and reliability. Due to the lack of rich practical construction experience, some inevitable difficulties are often encountered in the construction of long-span spatial steel structures. It is hoped that the constructors will strengthen the analysis methods of structural principles to ensure foolproof construction. The research on splicing algorithm before feature extraction in structural analysis of long-span steel structure construction shows that considering the splicing quality and time, it is recommended to choose difference matching algorithm. In practical application, after the equipment is installed and adjusted, the variation range of splicing position can be determined through experiments, and the search area can be directly taken as the variation range, so that the search area can be reduced exponentially, the calculation amount can be reduced exponentially, and the splicing time can be reduced exponentially.

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