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CONSERVATION DESIGN OF INDUSTRIAL HERITAGE BASED ON NONLINEAR GA OPTIMIZATION ALGORITHM AND THREE-DIMENSIONAL RECONSTRUCTION

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Abstract. In order to understand the industrial heritage protection design of Iterative reconstruction, the author proposes a research on industrial heritage protection design based on GA optimization algorithm and Iterative reconstruction. Firstly, the author establishes the 3D model of industrial heritage through Iterative reconstruction, and optimizes the model parameters through GA algorithm to achieve the purpose of protecting and utilizing industrial heritage. Secondly, the author proposes a method of Iterative reconstruction of industrial heritage based on GA algorithm, uses this method to conduct Iterative reconstruction of industrial heritage, and imports the reconstructed model into the 3D model management system for management. This method solves the problem of high reconstruction cost caused by low model quality in traditional Iterative reconstruction, and makes industrial heritage protection design more practical. Finally, an experimental analysis was conducted using a factory building in a certain city as an example. The results showed that the model optimized using the GA algorithm had significantly better performance than traditional reconstruction methods, and could more accurately reflect the spatial form and structural characteristics of industrial heritage, this provided new ideas and methods for the subsequent protection and utilization of industrial heritage. The GA algorithm optimized 3D model established by the author can effectively evaluate industrial heritage in historical urban areas, not only revealing the value of industrial heritage better, but also providing a certain reference for similar work in the future.

Key words: GA optimization algorithm, 3D reconstruction, industrial heritage protection design

1. Introduction. With the acceleration of economic development and urbanization, the rapid development of cities, and the shortage of urban land, the number of industrial heritage in cities has been increasing year by year, and its quantity is also constantly increasing. At present, China has carried out preliminary protection and utilization of industrial heritage. However, there are certain misunderstandings in the protection and utilization of industrial heritage, mainly manifested in: firstly, emphasizing the value of industrial heritage itself unilaterally while neglecting its social, economic, and cultural value; Secondly, simply redeveloping and utilizing industrial heritage, neglecting the relationship between its historical value and artistic value; Thirdly, it is believed that protection is the demolition and reconstruction of historical buildings, without realizing that protecting industrial heritage requires a comprehensive consideration from a macro perspective.

When protecting and utilizing industrial heritage, attention should be paid to a comprehensive evaluation of its historical, artistic, and socio-economic value. However, due to the long history of industrial heritage, the rich historical information and cultural value it contains often cannot be expressed in language or evaluated through traditional methods. Therefore, the author mainly studies how to use GA algorithm for three-dimensional modeling of industrial heritage in historical urban areas. GA algorithm is a global optimization algorithm based on Evolutionary computation, it solves optimization problems under multi-objective and multi constraint conditions by simulating biological genetic processes. In the GA algorithm, the most important aspects are the design of population size and selection operators. The larger the group size, the more optimal solutions will be obtained; The selection operator determines the direction and scope of group search. Therefore, selecting the appropriate population size and selecting the appropriate selection operator are the two most important issues in optimization algorithms. At present, GA algorithm is commonly used to solve nonlinear problems in optimization problems. The GA algorithm is divided into two stages: encoding stage and fitness function calculation stage. The fitness function calculation stage is divided into two types: Global optimization and local optimization. In addition, the GA algorithm can also be used to solve nonlinear problems (such as regression and clustering analysis) [1, 17] (Figure 1.1).

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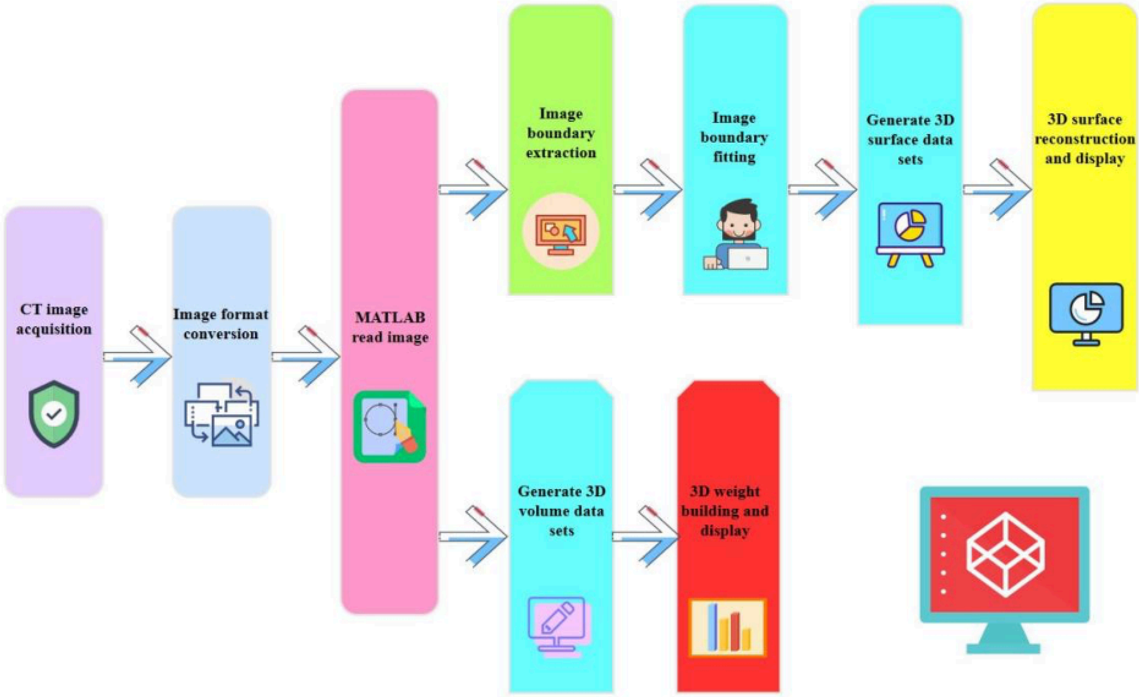

Fig. 1.1: Iterative reconstruction of industrial heritage protection design

2. Literature Review. Industrial heritage is a special product generated in the process of economic globalization and urbanization, which has a significant impact on urban development. In recent years, with the continuous renewal and renovation of cities, many industrial heritage sites have been abandoned. At the same time, people are paying increasing attention to the protection and reuse of industrial heritage, and research on its protection and reuse is also increasing. However, there are still some problems in the current industrial heritage protection design, such as the low quality of the model in the Iterative reconstruction process, the lack of a unified management system, and so on. These issues have had a negative impact on the protection and reuse of industrial heritage. In order to solve these problems, the author proposes a method of Iterative reconstruction of industrial heritage based on GA algorithm. First, we use computer graphics to model industrial heritage; Secondly, import the model into the 3D model management system for management; Finally, the GA algorithm is used to optimize the model parameters to achieve better modeling results. Industrial heritage is a product of industrial civilization, carrying the memory of a city and witnessing its history. However, due to the fact that most of the industrial heritage is old factory buildings, which themselves have high value, but due to their own characteristics, they are not suitable for development as tourist attractions. In recent years, many scholars in China have also conducted relevant research on industrial heritage. Lyu, S. Yangshan "ceramic industrial site as an example, on the basis of field research and photography of the site, we used Photoshop and 3 dsMax software to conduct 3D modeling of the site, and completed the Iterative reconstruction of the site [8]. Li, C., and others used laser scanners to measure and model the No.1 and No.2 blast furnaces of China First Steel Company, and visualized the models using VS2010 programming language [5]. Teng, X. and others proposed an industrial heritage protection plan by analyzing the historical value of China's First Steel Company's No. 2 blast furnace [12]. In the traditional Iterative reconstruction method, taking 3DMAX as an example, its parameter setting mainly includes point cloud data acquisition, point cloud data processing, curve generation, surface generation, etc. However, this method takes a long time and is inefficient. For this reason, the GA based optimization algorithm is applied to Iterative Reconstruction of Industrial Heritage.After modeling, we need to manage and query the model, which is convenient for the user to manage and utilize the model. To achieve the Iterative Reconstruction of Industrial Heritage, the first step is to construct a model.The usual way is to construct the model based on the structure features. When building a model, the resulting 3D model will be affected differently by different parameters. Therefore, it is necessary to optimize the model parameters for Iterative reconstruction of industrial heritage [13].

3. Research Methods.

3.1. A nonlinear optimization design method based on GA. CA is aimed at unconstrained problems, and for dynamic optimization design problems that are generally constrained optimization, conversion is required. Therefore, the dynamic optimization design problem is modified as follows:

Construct a penalty function as shown in equation (3.1):

$$F\left(b^j\right)=\Psi_0+S\sum_{i-1}^{m}\max\{0,g_i\}\,(j=1,2,\cdots,N) \tag{3.1}$$

g_i is the i-th constraint function, as shown in equation (3.2):

$$g_i(t,b,z)\leq 0(0\leq t\leq T,i=1,2,\cdots,m) \tag{3.2}$$

S is a large positive number.

Constructing Individual Moderate Function Equation (3.3):

$$G\left(b^j\right)=\frac{1}{\left|F\left(b^j\right)-c\right|} \tag{3.3}$$

where c is a positive number that is small enough.

The characteristic of dynamic optimization design is that the objective function and constraint conditions are functions of system parameters and system dynamics equation solutions. During the optimization process, numerical solutions of the system dynamics equation must be performed for each optimization. However, in practical applications, the general GA algorithm exposes the shortcomings of slow progress and multiple calculations of the evaluation function. The main reason for this is that there is too much randomness in the seed selection process, which covers the entire solution space. However, the overall quality is very poor, and many are even infeasible. It takes several generations of genetic iteration to improve the overall quality. Therefore, improvements must be made in order to be used for dynamic optimization design. In practical dynamic optimization design problems, they are often based on their original solutions, based on this characteristic, when forming the original group, the original plan is imposed as a part of the original group, and after a few iterations, the overall quality is rapidly improved [20, 10]. In addition, the composite method can also be used to optimize seed selection, which is described as follows:

Evaluate a group of schemes including k individuals, select the worst-case individuals, and modify them as follows: Take each individual in the group scheme except for the worst-case individual as a vertex of the polygon, and the centroid position of the polygon is expressed in equation (3.4)

$$x^r=x^c+\alpha(x^c-x^h) \tag{3.4}$$

By taking the above measures, the optimization process was accelerated and the optimization time was shortened, the modified algorithm is as follows:

(1) At the beginning (k=0), evenly divide the solution space of each design variable, randomly select a set of original solutions from these numerous small domains, and impose the original solution as a part of the original population based on the actual optimization problem,

(2) Solve the dynamic equation and obtain the penalty function $F(B_j)$ and fitness function $G(b_j)$.

(3) Selection: Based on the probability of inclusion in the original solution.

(4) Randomly select two independent individuals (including bm and bI) from the excellent varieties obtained in the previous step to hybridize and generate new individuals.

(5) Perform genetic mutations on individuals with $P_j \leq P_m$ (P_m is the probability of variation) and individuals with similar quality in the original solution to generate new individuals.

Table 3.1: Comparison table

	K_1/KN • m^{-1}	K_2/KN • m^{-1}	K_3/KN • m^{-1}	K_4/KN • m^{-1}
GA algorithm	8.75	35.13	42.18	1.95
traditional algorithm	8.72	36.00	43.001.95	2.36

(6) Form a new generation population of the same size as the original by combining the best and new individuals, and repeat steps (2) to (5) until the average moderate stabilizes.

In order to verify the effectiveness of the above methods, four optimization design problems for the five degree of freedom vehicle suspension system are selected as examples in this paper, as shown in Table 3.1.

The numerical example shows that the GA based dynamic optimization design method proposed by the author is feasible, and careful analysis shows that it has the following characteristics compared to other dynamic optimization design methods:

(1) Sensitivity analysis can be omitted during the optimization process;

(2) Minimal requirements for the objective function and constraints, and no feasibility requirements for the initial solution;

(3) The optimization search covers the entire solution space and performs heuristic searches based on genetic mechanisms, resulting in a high probability of obtaining the global optimal solution;

(4) It is equally effective for both nonlinear and linear problems.

4. Experimental Application of Iterative Reconstruction Industrial Heritage Protection and Renewal Design in a Factory. The author conducted a case study on the analysis of a factory area and the reconstruction of building environmental information models, vector data reconstruction and building performance analysis (building elevation, building shadow, solar radiation) were conducted on the factory, and the industrial heritage of the factory was updated and designed, including proposing update goals, protecting update positioning, and updating design strategies [19, 6].

4.1. Objectives and principles of protection and renewal.

4.1.1. Protection and update objectives. (1) Inject new vitality and strengthen the protection of the old factory. In the development of the city, the old industry is slowly disconnected from the development of the city, and the society and individuals have a weak awareness of the protection of industrial heritage. Industrial heritage is an important part of the social Collective memory, an inseparable culture of a city, and has a special status. The 156 projects in Xiangfang District are more important industrial plans after the founding of New China, which have important historical research value and technical value.These factories' construction techniques represent the advanced construction techniques and structure standards.In the meantime, these enterprises have taken in a lot of city residents, and have close relationship with city life and work. In recent years, because of the relocation of some factories, they have been abandoned, and many factories are facing the danger of being demolished.This paper discusses how to inject new elements into the old factory, change its functions and revitalize it, and make use of "active protection" instead of "static protection", so as to make full use of industry heritage and enhance the protection of industrial heritage.

(2) Improve the level of information protection of industrial heritage This paper explores the use of building information Iterative reconstruction technology for digital information collection of industrial heritage. With the advantages of digital information technology that is easy to preserve, process, observe, and analyze, 3D measurement and data processing of industrial heritage and the preservation of 3D data of building information in the original factory area are carried out. At present, the protection of industrial heritage faces great difficulties in the evaluation and data acquisition of architectural heritage. Traditional data acquisition and recognition models have significant limitations. The acquisition of traditional manual two-dimensional data makes it difficult for the data to intuitively display the information of the factory area, at the same time, there are certain errors that consume a lot of manpower and resources. Utilizing digital information technology in architecture to conduct data collection and auxiliary design planning for the factory will improve work efficiency and provide a demonstration role for data collection and planning of other industrial heritage sites [9, 14].

4.1.2. Protection and renewal principles. (1) The principle of historical inheritance is that the first thing to be done in the protection of industrial heritage is to protect historical heritage information. As a carrier of historical information, the protection and updating of industrial heritage should first respect the information of the original buildings, maintain representative elements, buildings, and spatial layout, reflecting the unique industrial culture of the city, when injecting new elements into the existing factory area, attention should be paid to the protection of existing information. For industrial buildings, attention should be paid to the protection of information related to the style and characteristics of the factory area, for example, attention should be paid to the protection of the facade decoration of the main buildings, the overall structure of the plant, the production facilities of representative production processes, and the overall spatial structure of the plant area. These elements constitute the urban Collective memory of industrial buildings, which play a vital role in the protection of industrial heritage, continue the history and culture of the plant, and rely on the existing buildings to establish a complete system for the protection of industrial heritage [15].

(2) The design of the urban sharing principle should combine the characteristics of Xiangfang District, aiming at connecting the original factory with the city, taking the factory as the test point, gradually combining with other old industrial sites in Xiangfang District, and ultimately serving the residents of the entire urban area, at the same time, it forms a brand effect, promotes tourism, drives the development of the entire region, generates positive feedback, and the positive effect is feedback on the protection of industrial heritage. Form a "people-oriented" space to enhance the urban service level of the entire region.

4.1.3. Evaluation of the building value of the factory. The process of industrial heritage protection and subsequent development and utilization can be summarized into three processes: investigation, evaluation, and decision-making. Among them, the evaluation of the value of industrial heritage is an important link. The evaluation of industrial heritage value is the evaluation of its value, as well as the evaluation of its preservation status and future development potential. The evaluation of its value through quantitative and qualitative methods can effectively propose decision-making effects for subsequent protection and updates.

(1) The evaluation factors and levels of industrial heritage are due to the weak awareness of protecting industrial heritage among most people, and the lack of strong policy and regulatory support for industrial heritage. Some valuable industrial heritage has been demolished, causing irreparable losses. Based on the Wuxi Recommendation and the Beijing Initiative, the country passed the Interim Measures for the Management of National Industrial Heritage in 2018, emphasizing the importance of industrial heritage protection and hoping to incorporate industrial protection into the government's urban planning and provide special funding support. And strengthen the publicity and reporting of national industrial heritage, and use Internet Big data, cloud computing and other means to create industrial art works; It is advocated to create Industrial tourism routes with popular science education, leisure and entertainment functions by focusing on "activation and protection" of industrial heritage and taking industrial heritage as the theme.

According to relevant domestic regulations, value evaluation can be divided into five categories, including historical value, technological value, social value, artistic value, and reuse value, these five categories are divided into 20 sub categories, and each sub category is divided into three grades, namely 0, 1 and 2 points. A score of 0 indicates that the item does not have the value, 1 indicates that it has general value, and 2 indicates that it has outstanding value [16, 18]. Divide the results into three levels: 1) Objects with special value can be protected with emphasis, maintaining their original characteristics without changing their characteristics and forms. The new use must be in line with the spirit of the original venue, and can be used as exhibition halls, exhibition halls, and other property buildings, and should not be developed as commercial properties. 2) By making appropriate changes to objects with general value, while protecting the appearance, structure, and landscape characteristics of the site, the function can adapt to the later functional needs. It can be transformed into a building type mainly focused on office, commercial, and tourism. 3) Buildings that do not require protection can be demolished or renovated according to the needs of later renovation. The evaluation criteria are shown in Table 4.1.

(2) Evaluation of the Building Value of the Factory - After investigation, we have classified the buildings within the factory area into production buildings, research office buildings, and ancillary buildings, an analysis and comparison were conducted on the historical value, social value, technological value, artistic value, and reusable value of buildings, and suitable buildings for preservation and buildings for reuse after renovation

Table 4.1: Industrial heritage evaluation factors

Value	Evaluation factor
Technological value	Style (architecture, environment) era
social value	pioneering
artistic value	Regional Characteristics and Aesthetic Characteristics of the Era
Reuse value	Physical availability, ecological value, location value

were classified, providing a basis for the planning, updating, and design of the later factory area. The site is roughly rectangular in shape. Within the site, the buildings are arranged in a regular manner, with production buildings occupying the main area of the factory. The main entrance is located on the side of Heping Road, and buildings 1 (the main building of the factory) and 2 (the cafeteria) are adjacent to the main entrance. There are some open spaces in the site planted with trees, including a small number of temporary factories [3].

4.2. Update and optimization of the industrial and overall layout of the factory park.

4.2.1. Subdivision of park industries. The construction of creative parks is not a traditional commercial real estate development project, but rather an industrial value operation based on industrial value space. The location and development positioning of creative parks are key factors for their successful operation, when positioning the industrial functions of the park, it is necessary to fully consider the local resource advantages and industrial foundation, avoid blindly following the trend and choosing industries without characteristics. When designing protective updates for industrial heritage, it is necessary to consider the resources, market, location, transportation, talent, and other aspects of the region. The era of large-scale industrial development has passed, and more detailed industrial segmentation has become the main development mode of contemporary times.

(1) The city has a long history of entertainment consumption. In the late 19th and early 20th centuries, with the construction of the Middle East railway, industry, commerce, and population gathered here. A city mainly focused on commercial port trade gradually formed, and the development of the city made commerce in the city prosperous. It is a popular tourist city and an international ice and snow city in the Northeast region, known as the “Little Paris of the East”.

(2) Exhibition function

Utilizing existing factories and open spaces can form exhibition spaces, which can provide space for enterprises or individuals to hold exhibitions and promote the cultural attributes of the park. The factory buildings in the park have the characteristics of large space and stable structure, similar to all building renovations. In the process of reusing the factory buildings, it is necessary to grasp their main characteristics and original elements that can represent their own value, during the renovation process, it is necessary to fully utilize the original structure and facade image of industrial buildings, preserve the original facade features, repair or replace some dilapidated components, and strive to reflect the value of their industrial heritage in the renovation results, so as to preserve the beauty of the original industrial buildings [7].

(3) Research Office

As the driving force of regional innovation, scientific research office can provide long-term driving force for the park and even Xiangfang District. At present, Xiangfang District, as a development area based on the old industrial zone, has gradually lagged behind other regions in terms of industrial production mode. The lack of investment in innovative research and development has slowed the economic development of the region. The introduction of scientific research and office work can promote the economic transformation of Xiangfang District, and is conducive to the diversified development of the park.

As shown in Table 4.2, for the renovation of the factory, a music area, exhibition area, creative office area, entertainment experience area, and commercial catering area will be set up. The functions of each partition are shown in the table below.

4.3. Digital 3D management of the park. The intelligent and information-based construction of creative parks combines the construction of the park with building 3D information models and 5G networks,

Table 4.2: Planning of park functions and content

Serial Number	Major function	Content planning
1	Musics	Music theater, music themed skits
2	Exhibition area	Cultural display, historical and cultural architecture display
3	Creative Office	Home of Creativity, Striving for the World, Cultural Education
4	entertainment experience	Catering, Fashion Release, Entertainment City

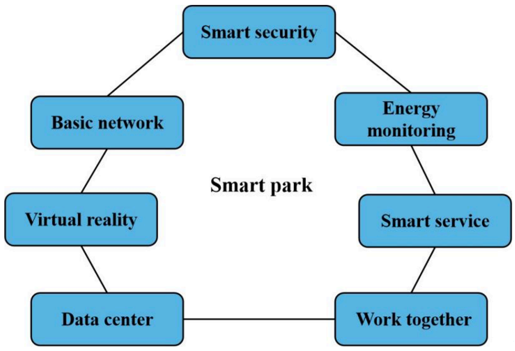

Fig. 4.1: General layout after renovationes

comprehensively improving the level of informatization, intelligence, and integration of the park, and enhancing its visibility; In terms of personnel access management, vehicle management, and material distribution, the combination of virtual reality platforms and networks enables real-time monitoring and management, achieving a safe and convenient office environment, and achieving a scientific management platform that is intelligent, personalized, and efficient.

The construction of smart parks is based on building environmental information models, utilizing internet connectivity to transform the operation and management of the park from a decentralized model to an intensive development model. Based on a large cloud computing platform, data is shared, and the operation of the park is connected with the government and enterprises, achieving a multi-party collaborative construction pattern. See Figure 4.1.

By combining photogrammetric models with GIS, a three-dimensional circular system is established that integrates data collection, management, maintenance, update, and application, achieving the transformation of park management from two-dimensional to three-dimensional management, reducing the difficulty of various management departments, through the continuous updating of architectural design models, the completed photogrammetric model will be combined with the BIM indoor model to realize the normal application of architectural design and park management and improve the overall informatization level.

4.4. Updating strategy for plant space protection. The renewal of the plant space focuses on the value of protecting industrial heritage. In view of the existing problems in the plant, based on the Iterative reconstruction model of the plant, the space composition, building conditions and environmental performance of the plant are analyzed, and the functions of the park and the leading industries are positioned, the spatial composition of the park has been determined, and the physical space and cultural environment of the park have been planned and designed. The specific strategy is shown in Figure 4.2. The renovation of the park includes material space renovation and cultural space renovation, and the material space includes buildings and their external environment, during the update process, following the basic principles of historical building renovation, protecting the original buildings from damage, maintaining the original architectural style, and preserving and inheriting the original historical and social values [11, 2, 4].

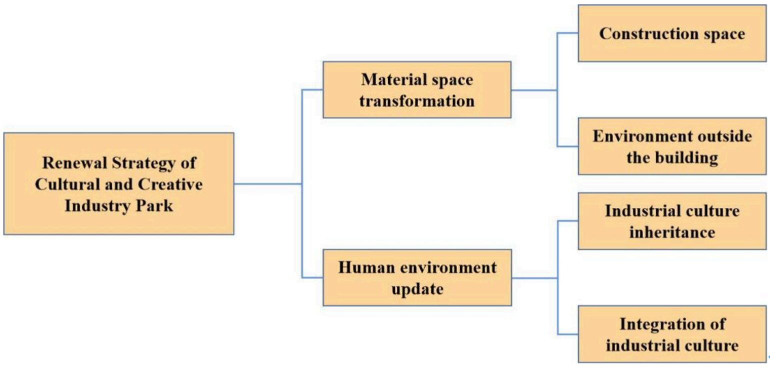

Fig. 4.2: Reconstruction of creative industries park

5. Conclusion. With the rapid development of modern society, the protection and utilization of industrial heritage has become a hot issue. The protection and utilization method of industrial heritage based on GA algorithm and Iterative reconstruction proposed by the author aims to protect industrial heritage by means of modern science and technology, by establishing 3D models, optimizing model parameters, and other technical means, the goal of 3D modeling, post model management, and extracting the value of industrial heritage is achieved. Finally, by positioning the protection and renovation of a certain factory area, the goals and principles of protection and renovation are determined, according to the Iterative reconstruction model and field survey, the buildings of the plant are classified and counted, the creative attributes of the park are determined, the spatial structure of the park is adjusted, and the plant is protected and renovated based on the Iterative reconstruction results. In the renovation, music is the theme, integrating new functions with industrial architecture to achieve new forms of expression of old industrial heritage, revitalizing industrial heritage and transforming it into a new driving force for urban development. The GA algorithm was used to optimize the 3D model, thereby improving the accuracy of the data and making it more in line with the actual situation.

REFERENCES

[1] H. Bennani, B. McCane, and J. Cornwall, *Three-dimensional reconstruction of in vivo human lumbar spine from biplanar radiographs*, Computerized Medical Imaging and Graphics, 96 (2022), p. 102011.
[2] M. Gallo, M. DI NARDO, L. C. Santillo, et al., *A simulation based approach to support risk assessment*, in Recent Advances in Automatic Control, Modelling and Simulation, ATHENs, WSEAS Press, 2013, pp. 86–92.
[3] R. Genoni, D. Pizzocri, F. Antonello, T. Barani, L. Luzzi, T. Pavlov, J. Giglio, and F. Cappia, *Three-dimensional reconstruction from experimental two-dimensional images: Application to irradiated metallic fuel*, Journal of Nuclear Materials, 548 (2021), p. 152843.
[4] ———, *Three-dimensional reconstruction from experimental two-dimensional images: Application to irradiated metallic fuel*, Journal of Nuclear Materials, 548 (2021), p. 152843.
[5] C. Li, G. Dong, and R. Wang, *A three-dimensional reconstruction algorithm of nonwoven fabric based on an anthill model*, Textile Research Journal, 92 (2022), pp. 1876–1890.
[6] Y. Li, J. Gao, X. Wang, Y. Chen, and Y. He, *Depth camera based remote three-dimensional reconstruction using incremental point cloud compression*, Computers and Electrical Engineering, 99 (2022), p. 107767.
[7] P. Liang, W. Zheng, and X. Xu, *Three-dimensional reconstruction method based on jitter optimization*, 1914 (2021), p. 012006.
[8] S. Lyu, Y. Wang, X. Li, J. Guo, C. Wang, and Q. Zhang, *Three-dimensional reconstruction of coronal mass ejections by the correlation-aided reconstruction technique through different stereoscopic angles of the solar terrestrial relations observatory twin spacecraft*, The Astrophysical Journal, 909 (2021), p. 182.
[9] ———, *Three-dimensional reconstruction of coronal mass ejections by the correlation-aided reconstruction technique through different stereoscopic angles of the solar terrestrial relations observatory twin spacecraft*, The Astrophysical Journal, 909 (2021), p. 182.
[10] Y. Peng, Z. Wu, G. Cao, S. Wang, H. Wu, C. Liu, and Z. Peng, *Three-dimensional reconstruction of wear particles by multi-view contour fitting and dense point-cloud interpolation*, Measurement, 181 (2021), p. 109638.
[11] H. Song, L. Zhang, F. Cao, H. Shen, Z. Ning, Y. Huang, X. Zhao, X. Gu, Z. Qiu, and J. Sun, *Three-dimensional reconstruction of bifilm defects*, Scripta Materialia, 191 (2021), pp. 179–184.

[12] X. Teng, G. Zhou, Y. Wu, C. Huang, W. Dong, and S. Xu, *Three-dimensional reconstruction method of rapeseed plants in the whole growth period using rgb-d camera*, Sensors, 21 (2021), p. 4628.

[13] F. Ullah, S. Miran, F. Ahmad, and I. Ullah, *A low-cost three-dimensional reconstruction and monitoring system using digital fringe projection*, Transactions of the Canadian Society for Mechanical Engineering, 45 (2020), pp. 331–345.

[14] ———, *A low-cost three-dimensional reconstruction and monitoring system using digital fringe projection*, Transactions of the Canadian Society for Mechanical Engineering, 45 (2020), pp. 331–345.

[15] X. Wang, Z.-y. Yin, J.-q. Zhang, H. Xiong, and D. Su, *Three-dimensional reconstruction of realistic stone-based materials with controllable stone inclusion geometries*, Construction and Building Materials, 305 (2021), p. 124240.

[16] L. Xin, X. Liu, Z. Yang, X. Zhang, Z. Gao, and Z. Liu, *Three-dimensional reconstruction of super-resolved white-light interferograms based on deep learning*, Optics and Lasers in Engineering, 145 (2021), p. 106663.

[17] H. Yoo and J.-Y. Jang, *Computational three-dimensional reconstruction in diffraction grating imaging by convolution with periodic δ-function array*, Optik, 249 (2022), p. 168211.

[18] Y. Zhang, X. Jiang, Z. Ma, Q. Yang, Y. Zeng, B. Deng, and H. Wang, *An efficient interpolation-free algorithm for cylindrical millimeter-wave holographic three-dimensional reconstruction*, Microwave and Optical Technology Letters, 63 (2021), pp. 1018–1023.

[19] J. Zhao, C. Feng, G. Cai, R. Zhang, Z. Chen, Y. Cheng, and B. Xu, *Three-dimensional reconstruction and measurement of fuel assemblies for sodium-cooled fast reactor using linear structured light*, Annals of Nuclear Energy, 160 (2021), p. 108397.

[20] S. Zheng, R. He, H. Chen, Z. Wang, X. Huang, and S. Liu, *Three-dimensional reconstruction and sulfate ions transportation of interfacial transition zone in concrete under dry-wet cycles*, Construction and Building Materials, 291 (2021), p. 123370.

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