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Similarity Theory and Its Application in Mechanical Engineering

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Abstract: *With the continuous development of society, science and technology, mechanical engineering industry in our country is making progress, in which similarity theory has played a great role. It plays a guide and reference role in mechanical engineering technology innovation and greatly promotes the development of mechanical engineering. At present, the application scope of the similarity theory is more and more wide, and the importance of similarity theory should be realized in mechanical engineering industry , and the specific core content of this theory should be understood and grasped. Scientific application of similarity theory should be given full play to utility with the understanding of actual development and the demand of the mechanical engineering to promote the long-term development of mechanical engineering industry.*

Keywords: *Similarity theory; Mechanical engineering; Application analysis*

1. Introduction

The so-called similarity theory, in its literal sense, is a theory that analyzes and explains objects and events with similarities in real life. In other words, it is to study and summarize the common points of similar things. If it is applied to mechanical engineering, it can play an important role in model architecture. Relevant technical personnel can make pre-function design by using computer simulation technology, through corresponding virtual form and the application of prototype model. In short, it is a scientific construction of mechanical engineering model based on the similarity theory. This has a positive effect on improving the design and production technology of mechanical engineering. Therefore, related mechanical engineering industry should pay more attention to similarity theory and apply it reasonably.

2. Overview of similarity theory

2.1 The meaning of similarity theory

In real life, effective application of similarity theory can be carried out for scientific analysis and explanation of different types of phenomena, which can also be said to be the research and analysis of the common ground between similar things. In the process of concrete model construction, similarity theory can be applied to provide great help for model construction. In the model construction, relevant technical personnel should also apply computer simulation technology to reasonably construct relevant virtual formationion based on the predetermined function and structure. Meanwhile, similarity theory should be used as the guidance basis to make the final realization of the model construction. In the actual development process of similarity theory, it also needs multiple theoretical foundations to provide support, mainly involving the following points. Firstly, it can give reasonable definitions to the various action phenomena in nature; Secondly, for a phenomenon, its physical principle presented is in accordance with the objective law, and there is no contingency; Thirdly, when measuring the relevant physical quantity in a certain phenomenon, one should not rely on one's subjective experience, because physical quantity is an objective thing [1].

2.2 Application status of similarity theory

At present, the application scope of similarity theory is relatively wide, and its own application not only involves the research field of physical problems, but also in the field of engineering design. With the continuous development of science and technology in our country, similarity theory absorbs more

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new technological and theoretical knowledge, and plays an active role in actual production and life. For physics phenomenon, its itself is part of the similarity theory, and also forms the basis of similarity theory, which can be used for in-depth research and analysis according to the corresponding event on the basis of physics phenomenon and able to work in actual process to study related systems. In this process, relevant mathematical algorithm and functional relationships can be made full use of to validate the final results. Similarity theory has a relatively wide range of research in physical functions, so it has been applied in many industries. Besides machinery, it also plays its own guiding role in other industrial production research fields. The application of similarity theory in the field of mechanical engineering can provide reasonable guidance for various problems existing in mechanical engineering and help relevant technical personnel to solve complex engineering problems [2].

3. Application analysis of similarity theory in mechanical engineering

3.1 The application analysis of similarity theory in the research of different mechanical engineering technologies

Now, in the specific process of mechanical engineering development in our country, similarity theory is applied to many types of machinery and machinery repair research and development, and also plays an effective role of guidance. In terms of the specific situation, similarity theory will also be applied to similar simulation manufacturing, grouping technology, similar simulation and other links involved in mechanical engineering, and will have different guiding roles in different links. For example, in the field of mechanical engineering, group technology arouses great attention and this technology is to make full use of the similar characteristics between different things based on objective existing rules. Meanwhile, the same pattern is adopted to delve into the same effect as well as the properties of different things. At present, with continuous development, electronic information technology has provided the corresponding technical support and basic guarantee for the organic integration between related group technology and automation control technology, which also promotes the process of information production construction and speeds up the realization of relevant production construction goal. Group technology has also been widely used in mechanical manufacturing, design and other industries [3].

In the specific application process of similar simulation technology, it is necessary to scientifically and reasonably control relevant physical parameters such as potential difference and the current in simulation circuit. On this basis, the predetermined logical operation goal can be achieved. The application of similar simulation technology has relatively high requirements on the professional ability and practical experience of researchers. Therefore, when applying this technology, it may fail to effectively control system operation in the first time. In order to make up for the defects in the application of the technology, digital technology can be applied scientifically to improve the application effect of the technology.

3.2 Application analysis of similarity theory in mechanical design

3.2.1 System analysis

The so-called system is a unified whole composed of at least two elements, which itself has comprehensive behavior and overall function. In general, a system is a machine that is composed of multiple constructs that can perform corresponding actions and have specific functions. Generally speaking, a machine consists of a number of mechanisms, and these mechanisms can be connected with each other, which involves corresponding transmission system. Therefore, the similarity of mechanical systems refers to the similarity between the mechanism and the machine [4].

For a mechanical system, itself is composed of a number of different structural units, such as working operation, transmission and so on. Moreover, different independent units are more likely to be a similar level, and the mutual combination of different units and levels can form different sub-similar systems. If the traditional unit belongs to the gear type transmission structure, the whole traditional unit can be regarded as a subsystem when it is designed similarly. When related technical personnel make analysis on the similarity of related mechanical systems, it is the analysis and research of the similarities between the system and its internal components, so that it can be applied to the new design process, thereby improving the design effect.

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3.2.2 Simplify the model

To simplify the model, one needs to choose the parameters with high complexity. In most cases, the parameters added in the design will not affect the normal operation of the system, but if the relevant parameters are removed, the system operation may be adversely affected. Therefore, relevant designers should scientifically analyze the impact level when selecting parameters, which involves theoretical knowledge and skills of data reasoning. In the process of model simplification, the numbers of part parameters and similar parameters are taken as corresponding data reference in order to obtain the corresponding similarity parameter value. At the same time, the designer should scientifically choose similar parameters based on similarity measurement and parameter values to effectively simplify model.

3.2.3 Design of mechanical parts

In actual design process, related design personnel should estimate the design goals and engineering scientifically, and make clear the related functions of mechanical engineering. On the basis of this, in view of the existing structure of mechanical parts, make comprehensive and in-depth analysis by using similarity theory and make preliminary simulation components parts with the help of the corresponding information technology. Then, the relevant designers may make effective simulation of the specific operation of the mechanical system. In the process of simulation, find out the problems existing in the mechanical system, and then make scientific and reasonable correction for the unreasonable internal structure in the system. After correction, simulate once again in order to guarantee the normal operation of the mechanical system. In addition, based on similarity theory, repeated simulation experiments can realize the comprehensive testing of mechanical parts, such as effective testing of parts for reserve function complete ability, structure and performance. The clearance of the unreasonable places in time make it more convenient to modify and improve the mechanical parts structure and provide basic guarantee for the construction of safe and efficient system.

3.3 Application of similarity theory in integration analysis of mechanical systems

In the application of similarity theory in mechanical engineering, related technical personnel can make full analysis about the overall operation and operation ways of the mechanical system model works. In book function and operation characteristics of mechanical system, start from the overall perspective of the mechanical system, and make simulation analysis on the similarity between different mechinaries. In practice, this process also has a certain similarity with the design process of mechanical parts. In specific mechanical similarity analysis work, relevant technical personnel should be on the basis of the whole mechanical system because similarity analysis involves a large number of professional theory knowledge, practical experience, and corresponding data information. In the process, any faults can cause a lot of resources waste. In such situation, the actual function of similarity theory can be played out. In concrete simulation work, technical personnel should take advantage of similarity theory to build the overall framework of the model, and simplify the whole process scientifically. Meanwhile, reservation function can be used to make reasonable filling to related components with similar functions, and the relevant parameters in the process of model operation are recorded in detail and analyzed scientifically. So the problems existing in the system also can be discovered. By adjusting them in time, the perfect model of mechanical system finally forms and it can be put into mechanical production applications after making sure there is no problem by making repeated practice and tests .

4. The application analysis of similarity theory in related fields

The application of similarity theory involves corresponding model tests. The model itself has the advantages of low cost, short time, and higher accuracy, and it also has good predictability. Therefore, it has been widely used in many engineering fields such as engineering, aviation, and geological structure. With the development and application of model test, it has gradually become an important channel for scientific research and engineering design. In addition, similarity theory, also known as similar engineering, is a new theory put forward in mechanical engineering applications after the deep research of similarity theory analysis. This theory not only embodies the literal meaning, but also involves several other related areas, such as mechanical engineering field, some similarity scientific research project in the nature, and social activities. For example, similarity theory can be used to comprehensively analyze the similarity laws in earth acoustic system, so as to innovate and upgrade the related industries, realize the effective maintenance of ecosystem balance, and develop urban

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ecological industry to promote the sustainable development of the city. Related researchers can also use similarity theory to carry out scientific research in the fields of similarity management engineering, production engineering, design engineering and so on. Similarity theory can be used for in-depth research on electrical appliances, electronic products and so on in the construction of engineering machinery manufacturing. On the basis of similarity theory, the similarities of different economic production modes can also be analyzed to promote economic exchanges between different regions.

5. Conclusion

Similarity theory itself is an independent discipline, and its application and development have larger room for advance. The organic combination with mechanical engineering may produce new knowledge, theory, or new technology. This needs more in-depth research, and users also need to deepen the understanding of the theory and improve the original theory system and its application effect with actual application to promote the long-term development of mechanical engineering industry.

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