Construction Mechanics and Time-varying Mechanics
Foundation of Civil Engineering Analysis

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Abstract. The rapid economic development of society, led to the development of civil engineering industry, civil engineering construction projects increased, its scale is also growing, at the same time, with the complexity of engineering projects, in the process of construction safety accidents are also rising. One of the most important aspects leading to construction safety accidents is that the situation that may occur in the specific construction process is not fully considered in the design of the whole project. The proposal of construction mechanics and time-varying mechanics in civil engineering is the standard of civil engineering analysis, which makes civil engineering analysis tend to be scientific and reduces the occurrence of safety accidents in the construction process.

Keywords: Civil Engineering, Construction Mechanics, Time-varying Mechanics

1. Construction mechanics in civil engineering analysis
With the rapid development of economy, the scale of civil engineering projects is expanding. Large projects, including tall buildings, buildings with a considerable span, underground buildings, dams, marine engineering, etc., are increasing. They are large-scale construction, wide-ranging, long-lasting, complex process[1]. At the same time of the increasing scale of civil engineering construction, accompanied by the increase of safety accidents in the process of civil engineering construction, which seriously brings harm to people's life and property safety and affects the efficiency of engineering construction. Therefore, it is meaningful for the analysis and research of civil engineering.

1.1. Foundation of construction mechanics and Mathematics
In the subject of civil engineering, time-varying mechanics is the most basic thing of construction mechanics. This is because in civil engineering projects, the object of construction mechanics research is changing with the flow of time. Mechanics is not immutable. It will develop with time. In this change, new ideas will emerge at the same time[2]. Most of these ideas are based on the change of time, but the basic principle of mechanics is constant, that is, the components of mechanics are constant. However, with the development of economy and the continuous innovation of technology, some ideas at the beginning have not kept up with the current level of development, which leads to the research of
mechanics paying more attention to its constituent elements. In this case, time-varying mechanics is born. In the actual production, some civil engineering projects are based on time-varying mechanics.

At present, for the analysis of civil engineering, we should refer to mathematics. In the specific construction process of civil engineering projects, the analysis of the internal factors of civil engineering needs to use calculus in mathematics. Therefore, in the analysis of civil engineering, the mathematical knowledge of time-varying is involved. In the specific civil engineering analysis process, the construction analysis of time-varying mathematics will inevitably encounter many difficulties, which needs to pay attention to the analysis and research in the specific practical operation.

1.2. Mechanical effect in civil engineering construction analysis
There are two kinds of mechanical effects in civil engineering construction analysis, that is, time effect and road effect. The first type of time effect is that in the architectural design of the same structure, because different design schemes are selected, the final result is different, and the state of mechanics is also different. For example, in the actual construction process, the state of building materials will change with time, which is the time effect factor of construction mechanics in civil engineering. The second type of road effect, in the actual construction process, due to the inconsistent construction scheme, the construction process and the final results of construction mechanics are different, resulting in different states. In the specific civil engineering construction process, the geometric properties of raw materials can cause the road effect of construction mechanics.

2. Time-varying mechanics in civil engineering analysis
In the process of civil engineering analysis and construction, the analysis of stress is an indispensable part of large engineering design and calculation. In the analysis of construction mechanics, the extreme value or the final result is very different from the general non-construction mechanics analysis method. The difference is as small as one time, as large as three times, so we need to pay more attention to it. Time varying mechanics is mainly divided into four parts, as shown in Figure 1.

![Figure 1. Time varying mechanics](image)

2.1. Time varying mechanics of physical properties
In the process of civil engineering analysis and construction, the physical properties of some building materials will change with the progress of construction, and the construction materials that will change belong to the category of physical time mechanics. For example, the physical properties of building materials such as concrete used in the process of construction will change to a certain extent after use, so the calculation of its construction belongs to the category of physical time-varying mechanical analysis. In this kind of time-varying mechanical analysis, we should pay special attention to the distinction of time function. If we use time function, we can directly use the equations in mechanics for analysis and research.

2.2. Linear elastic time-varying mechanics
In the construction process of civil engineering analysis, if the selected construction material is linear elastic and has no thermal effect. In the whole construction process of the project, the construction
cycle time is far longer than the cycle time when the system itself sends out vibration. In such a case, the static analysis method can be used without considering the results caused by inertia. Then, the construction of civil engineering analysis belongs to linear elastic time-varying mechanics. In the previous analysis methods, the spatial variable equation was used in the analysis of this kind of problems at the beginning, but in the current situation, because the physical factors and geometric range factors will change with the change of time, which makes careful analysis and calculation in the actual construction process, and then the time variable parameters appear.

2.3. Viscoelastic time-varying mechanics
In the process of civil engineering analysis and construction, a lot of construction materials are used. With the progress of construction, some construction materials will change with the change of time. The construction materials with this characteristic have certain rheological properties. In the construction mechanics of civil engineering analysis, the analysis of such problems belongs to the category of viscoelastic time-varying mechanics analysis⁶. In the actual operation process, based on the time-varying coupling of time parameters, physical parameters and geometric range, the variables in time and space at the beginning are transformed into equations with parameter changes. In the actual construction process, materials used in construction such as concrete, asphalt and clay have such rheological properties. The construction analysis of these raw materials belongs to the category of viscoelastic time-varying mechanical analysis.

2.4. Nonlinear time-varying mechanics
In the process of civil engineering analysis and construction, the materials used in the construction process have certain nonlinearity, so the construction analysis of this part of materials is included in the category of nonlinear time-varying mechanical analysis. In the process of excavating the foundation, viscoelastic time-varying mechanics can be used for analysis. Another feasible method is to use integral transformation. In the calculation range of non linear time-varying mechanics, the final results are affected by many factors, including the initial use process, geometric range, physical factors and so on. In fact, in non linear analysis, the final results of time-varying analysis and traditional analysis methods are different. Nonlinearity includes physical nonlinearity, boundary nonlinearity and geometric nonlinearity, and these three categories are subdivided into many small aspects. In the practical solution, the differential equation in mathematics can be used.

3. Conclusion
In the construction process of civil engineering analytical mechanics, it is based on time-varying mechanics, including linear elasticity, viscoelasticity, nonlinearity, thermoelasticity and time-varying mechanics of physical properties. In order to break through the problems in the mechanical analysis of civil engineering construction, it is necessary to pay attention to the research of time-varying mechanical numerical method and its general program in the process of construction, so as to find a good method for construction analysis and calculation. In the process of civil engineering analysis and construction, it should be studied according to the characteristics of different engineering types, such as structural engineering, foundation engineering, underground engineering, dam engineering, bridge engineering, marine engineering, etc. There should be different solutions for different types of projects. All human and material resources should be collected together for research, and effective solutions, processes and systems that only belong to this category should be developed. This is urgent to be solved in the future. The research on the construction mechanics of civil engineering analysis will have a profound impact on the whole civil engineering.

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