On The Response Plan of Steel Structure in Earthquake Resistance

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Abstract: in view of the failure of steel structure under earthquake, the stability problem has always been one of the key problems in steel structure design. The extensive application of structural system highlights the importance of stability research.

1. Introduction
In recent years, with the rapid development of China's economy, steel structure as a new building form and the application of steel structure is more and more extensive. Whether it is high-rise, such as super high-rise and light steel structure and large-span space structure etc are widely used because of its fast construction speed, short period and good seismic performance. Therefore, it is necessary for us to study the steel structure. There are many kinds of failure modes of steel structure, the phenomena of steel structure and the failure modes of steel structure in our country at present, and what countermeasures should be taken for these failure modes.

According to the failure mode, the accidents of steel structure can be roughly divided into failure of bearing capacity and rigidity of steel structure; instability of steel structure; fatigue of steel structure; brittle fracture of steel structure and corrosion of steel structure.

2. Steel structure bearing capacity and rigidity failure

2.1. bearing capacity failure of steel structure refers to the damage caused by the strength of structural members or connecting materials being exceeded in normal use. The main reasons are as follows:

① The strength index of steel is unqualified. There are two important strength indexes of 636f70797a6864616f3133337623538 in the qualified steel structure design: yield strength FY; in addition, when the structural members bear large shear or torque, the shear strength FV of steel is also an important index.

② The connection strength does not meet the requirements. The strength of the welding connection depends on the strength of the welding material matched with the base metal, the welding process, the quality and defect of the weld and its inspection and control, the influence of the welding on the strength of the heat affected zone of the base metal, etc.; the influencing factors of the bolt connection strength are: the quality of the bolt and its accessories, the effect of the heat treatment (high strength bolt), the control of the construction technology of the bolt connection, especially the high quality.

③ Changes in service loads and conditions. It includes the overload of the calculated load, the additional stress caused by the withdrawal of some components from the work, the accidental impact load, the additional stress caused by the temperature change, the additional stress caused by the uneven settlement of the foundation, etc.
2.2. steel structure stiffness failure refers to the plastic deformation or vibration that affects its continuous bearing or normal use. The main reasons are as follows: ① the rigidity of the structure or component does not meet the design requirements, such as the axial compression component does not meet the slenderness ratio requirements; the bending component does not meet the allowable deflection requirements; the bending component does not meet the above two requirements. ② Insufficient structural support system. Support system is an important part to ensure the overall and local stiffness of the structure. It is not only beneficial to resist horizontal load and vibration, but also directly affects the normal use of the structure (for example, when the overall stiffness of industrial plant is insufficient, vibration and shaking will occur during the operation of crane).

3. instability of steel structure

3.1. the instability of steel structure mainly occurs in the axial compression, bending and bending components. It can be divided into two categories: loss of global stability and loss of local stability. Both kinds of instability will affect the normal use of structural members, and may cause other forms of damage. Surface method

4. Problems in the study of stability of steel structure system

Although the research on the stability of steel structure system has made some progress, there are some problems that can not be ignored. At present, beam column element theory has become the main research tool in the study of the stability of latticed shell structure. However, it is difficult to say whether the beam column element can truly reflect the stress state of the latticed shell structure, although some scholars have modified the beam column element. The main problem is how to reflect the coupling effect of axial force and bending moment. ② In the design of long-span structure, the relationship between the overall stability and the local stability is also a problem worthy of discussion. At present, taking a unified stability safety factor in the design of long-span structure does not reflect the correlation between the overall stability and the local stability. ③ The stability design theory of pretensioned structure system is not perfect, and there is not a complete and reasonable theoretical system to analyze the stability of pretensioned structure system.

4.1 Reliability research on stability of steel structure system

The actual structure is different from the ideal structure because of various random defects. For defect sensitive structures, defects may cause a sharp decline in structural stability, so it is necessary to consider the impact of random parameters, and introduce reliability analysis method to study the reliability of stability problems. Because the research on the reliability of long-span steel structure system involves more mechanical and mathematical knowledge, it is difficult to do so. At present, the research results in this field are limited.

4.2 sources of uncertainty in structural analysis

Many basic variables that affect the stability of rigid structure system are random, which are generally divided into three categories:

① physical and geometric uncertainties: for material (elastic modulus, yield stress, Poisson's ratio, etc.), member size, sectional area, residual stress, initial deformation, etc. ② Statistical uncertainty: in the statistics of physical and geometric quantities related to stability, the probability density distribution function is always selected according to the limited samples, so it brings some experience. This kind of uncertainty is called statistical uncertainty because of the lack of information. ③ Model uncertainty: in order to analyze the structure, the proposed assumptions, mathematical models, boundary conditions and various factors that are difficult to be reflected in the calculation of the current technical level, resulting in the difference between the theoretical value and the actual bearing capacity, are all attributed to the model uncertainty.
4.3 structural reliability study
Scholars at home and abroad have carried out more in-depth research on the theory of structural
t reliability, and have made a lot of research results in reliability calculation methods and reliability
analysis of complex structures.

The ultimate purpose of any engineering analysis and design is to make the designed structure meet
different functions - safety, usability and durability under different requirements. Due to the existence
of uncertainty, it is necessary to add these uncertainties into the engineering design, resulting in a lot
of reliability methods. In order to estimate the reliability of the structure, it is necessary to first solve
the relevant load and resistance parameters and the functional relationship between them. This
relationship (also known as the functional function) is recorded as x1, X2, xn is a random variable.
When the limit state (or failure surface) is defined as Z0, the parameter reliability index describing
reliability is defined as the minimum distance from the coordinate origin to the failure surface. At
present, there are generally two methods for reliability index calculation: the primary reliability
method (form) and the secondary reliability method (SORM).

4.4 review of current numerical methods for structural reliability analysis
These numerical methods are generally divided into three categories: Monte Carlo simulation method
(including efficient sampling method and variance reduction technology), response surface method
and sensitivity based analysis method.

① Monte Carlo simulation

The basic idea of Monte Carlo simulation method is to generate a group of input variables
randomly before each deterministic analysis, after a large number of repeated deterministic analysis,
the response output parameters of the structure are statistically analyzed to calculate the reliability of
the structure. Combining Monte Carlo simulation with finite element method, Monte Carlo finite
element method is obtained. Monte Carlo finite element method is usually used as the relatively
accurate solution of reliability calculation, but in order to achieve high accuracy, enough samples must
be taken, so the calculation work is quite large.

② Response surface method

In essence, response surface method is a set of statistical methods, which is used to find the best
response value after considering the variation or uncertainty of input variables. The failure probability
is calculated by primary or secondary reliability method. In response surface method, for a problem
with a large number of random variables, the deterministic analysis required to accurately construct an
approximate polynomial is quite huge, so this method is very time-consuming. Even for a problem
with a small number of random variables, the accuracy of response surface method for reliability
estimation is related to the accuracy of approximate polynomial of function function.

③ sensitivity based analysis method

The combination of sensitivity based analysis method and first reliability method (form) / second
reliability method (SORM) can overcome the shortcomings of Monte Carlo simulation method and
response surface method. In the process of finding the control point (also called the minimum distance
point), the information used in each iteration is the true value and true gradient of the function function,
and the optimization method is used to make the control point converge to the minimum distance point.
Compared with Monte Carlo simulation method and response surface method, it takes less time and is
more accurate than response surface method.

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5. Conclusion

at present, the research of steel structure in our country has entered a new stage, the relevant
specifications have been issued, and the domestic steel output is sufficient to provide a better material
and technical basis for the development of steel structure. It is necessary to grasp the development
trend in time, and pay attention to the mutual cooperation between disciplines in combination with the national conditions of our country, so as to promote the development of steel structure.

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