Calculation and Classification Method of Member Importance of Spatial Latticed Structure in Service

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Abstract

Sampling method is widely used in the inspection of spatial latticed structure in service. And different sampling quantity of members in different importance levels will be determined by importance coefficient calculation method. However, the current member importance calculation methods are majorly based on linear elasticity assumption and Alternative Path Method (APM), lacking the consideration of spatial latticed structure's nonlinearity characteristics and actual possibility of a member being completely destroyed.

In this paper, a calculation and classification method of member importance is proposed based on strain energy. Firstly, the concept of total strain energy of spatial latticed structure in critical state of overall stability is introduced, and the total strain energy is calculated based on load-displacement relationship. Next, the member importance coefficient is defined by the reduction rate of total strain energy caused by member damage. Then, the effect of different minor damage cases acting on the member is studied. Finally, the classification method is proposed based on safety assessment criterion and importance coefficients of members, and structural members is divided into important members and ordinary members.

For numerical simulation, member importance coefficients of single-layer spherical latticed shells and cylindrical latticed shells under uniform load with different span length are taken into consideration. Based on the numerical results, several conclusions are drawn in this paper: (1) The member importance coefficients calculated by the method proposed in this paper could effectively consider structure's mechanical properties and load condition; (2) In spherical latticed shells, the important members distribute radially, while in cylindrical latticed shells they are close to the supports; (3) The distribution of important members don't change with span length.

References

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