Multi-level objective optimization method for high rise frame shear wall structure

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Abstract

Automatic optimum design is the future development trend of structural design. The main purpose of this study is to propose an automatic optimum design method for building structures. Based on the Bidirectional Evolutionary Structural Optimization(BESO) method, this paper introduces the concept of multi-level objective, and proposes Multi-level objective Optimization Method(MLOOM). By reducing the constraint redundancy of structural members, this method can reduce the structural cost as much as possible and allocate the structural materials reasonably. MLOOM is close to the practical engineering experience, and improves the efficiency and effect of optimization based traditional algorithm. Taking two story and ten story steel frame shear wall structure as examples, the efficiency and economy of the optimization method are illustrated.

Keywords:automatic optimum design; BESO; MLOOM; constraint redundancy; frame shear walls structure

1 Introduction

In modern times, structural optimization design is mainly based on the effective application of mathematical algorithm and computer science. From the initial optimization of structural weight to the optimization of structural stiffness, strength and safety performance, it has been continuously expanded and sublimated. It provides an advanced tool for the long-term pursuit of the optimal engineering structure design, especially for the new structure design, and has become one of the important contents of modern design methods.

Since the second half of the 20th century, modern optimization algorithms with certain self-organization and self-adaptability have been formed by simulating biological behaviors or various natural phenomena. It mainly includes genetic algorithm (GA), artificial neural network (ANN), immune algorithm (IA) and ant colony algorithm (ACA). In the process of studying the effect of Annealing on the development and perfection of metal crystals, a simulated annealing algorithm (SA) was developed to simulate the generation of natural substances. These new optimization methods have the advantages of being able to search the global optimal solution and being easy to implement.

Structure optimal design method is generally based on optimization algorithm. Xie [1] used the bi-directional evolutionary structural optimization algorithm to carry out architectural design, and through a series of cases, elaborated the use of bi-directional evolutionary optimization algorithm to generate beautiful and efficient forms, and revealed the important role of modern structural

https://doi.org/10.2749/ghent.2021.0917
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