Automation of seismic design of high-rise structure with braced steel frame

Xin Zhao

Department of Structural Engineering, Tongji University, Shanghai, China

Tongji Architectural Design (Group) Co., Ltd, Shanghai, China

Gang Wang

Department of Structural Engineering, Tongji University, Shanghai, China

Jinlun Cai

Department of Structural Engineering, Tongji University, Shanghai, China

Junchen Guo

Department of Structural Engineering, Tongji University, Shanghai, China

Contact: 22zx@tjad.cn

Abstract

With the continuous development and progress of society, the structure of high-rise buildings has been paid more and more attention by the engineering community. However, the existing high-rise structure design methods often have a lot of redundancy and have a lot of room for optimization. Most of the existing seismic design methods of high-rise structures are based on engineering experience and manual iterative methods, so that the efficiency of design can not meet the needs of the society. if the method of design automation is adopted, the workload of designers can be greatly reduced and the efficiency of structural design can be improved. Based on the digital modeling theory, this paper proposes a MAD automatic design algorithm, in which the designer provides the initial design of the structure, and the algorithm carries out the modeling, analysis, optimization and design of each stage of the structure, and finally obtains the optimal structure. The structural design module of this algorithm starts from the component level, when the component constraint design meets the limit requirements of the specification, it enters and completes the component constraint design and the global constraint design of the structure in turn. In this paper, taking a ten-story braced steel frame high-rise structure as an example, the optimal design is carried out, and its seismic performance is analyzed. the results show that the MAD automatic design algorithm can distribute the materials to each part reasonably, which can significantly improve the seismic performance of the structure and realize the effective seismic design.

Keywords: MAD automatic design algorithm; braced steel frame; high-rise structure; seismic design.

https://doi.org/10.2749/ghent.2021.1917
Distributed by structurae