



Sensitivity data driven optimal design for steel frame tall buildings

Chenyun Zhang

Department of Architecture and Urban Planning, Guizhou University, No. 2708 South Section of Huaxi Avenue, Guizhou, Guiyang, China

Yong Huang

Department of Architecture and Urban Planning, Guizhou University, No. 2708 South Section of Huaxi Avenue, Guizhou, Guiyang, China

Xin Zhao

*Department of Structural Engineering, Tongji University, No. 1239 Siping Road, Shanghai, China
Tongji Architectural Design Group, No. 1230 Siping Road, Shanghai, China*

Jinlun Cai

Department of Structural Engineering, Tongji University, No. 1239 Siping Road, Shanghai, China

Contact: 272712850@qq.com, 68589850@qq.com, 22zx@tjad.cn, 1932591@tongji.edu.cn

Abstract

Structural design generally involves hundreds of design variables and multiple constraints in practical engineering projects, nevertheless, traditional optimization techniques are failed to meet the engineering requirements for solving the optimization problem with high efficiency and accuracy. In this paper, a single driven constraint optimization method based on constraint sensitivity is presented for high-rise steel structure. The design method takes the sensitivity coefficient as the reference index for the optimization design of components to ensure proper compliance and redundancy requirements. An effective incremental analysis method is applied for the calculation of sensitivity coefficients within constraints and design variables. Sensitivity coefficients based material redistribution of components is carried out to make the structure achieve the optimization objective on the premise of satisfying all the design constraints.

Keywords: Steel frame structure; Sensitivity analysis; high-rise buildings; Modeling-Analysis-Design (MAD) Methodology

1 Introduction

With the popularity and development of high-rise building structures, as well as people's attention to the economy, safety and environmental

performance of building structures, the demand for structural optimization technology in the construction industry is increasingly strong.