Weight Optimization of Steel Frames with Semi-Rigid Connection in Time History Analysis by GA

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Abstract

The realistic modeling of beam-to-column connections plays an important role in the analysis and design of steel frames. A genetic algorithm based optimum design method used for nonlinear multistory steel frames with semi-rigid connections. The mentioned algorithm is employed as optimization method which utilizes reproduction, crossover and mutation operators.The design algorithm obtains a frame with the least weight by selecting appropriate sections such as wide flange steel sections of AISC standard.Finally, allocated semi-rigid connection stiffness to the beam-column connection would be obtained. During the procedure of optimization the amounts of these rigidities create by genetic algorithm in order to reach the minimum weight of frames. To perform modal analysis, linear static and non-linear static operations as well as design of elements, SAP2000 software and to perform the optimization procedure, the program written in MATLAB software domain have been used.Displacement and stress constraints of AISC-Load and Resistance Factor Design (LRFD) specification and also size constraints for beams and columns are imposed on the frame.Furthermore, the P−Δ effect is also accounted for in the analysis and design of the multistory frame. The result of this research was compared with result of previously published paper in this field

Key words: Optimization, Genetic Algorithm, Semi-rigid Connection, Time History Analysis, Plastic Hinge.

1. Introduction

Genetic method is an accidental search which is highly capable for solving discontinuous problems [1]. This optimization method works with the design variables in the form of strings with definite lengths codified as zero and one (binary number). The researches have shown that the moment–rotation (M-θ) relationships for some of the connections are