SIZING OPTIMIZATION OF FRAME TUBE STRUCTURES SUBJECTED TO WIND INDUCED LOADING BY MINE BLAST ALGORITHM

Mohsen SHAHROUZI
Assistant Professor, Faculty of Engineering, Kharazmi University, Tehran, Iran
shahruzi@khu.ac.ir

Afshin MESHKAT-DINI
Assistant Professor, Faculty of Engineering, Kharazmi University, Tehran, Iran
meshkat@khu.ac.ir

Ahmad AZIZI
M.Sc. Student, Kharazmi University, Tehran, Iran
std_aazizi91@khu.ac.ir

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Structural design of tall buildings is an engineering challenge due to considerable difference between several possible alternatives. Cardinality of such a search space is too high to be perfectly handled by a few human guesses; that is manual design. Alternatively, computerized sizing optimization as a systematic solution is concerned here using meta-heuristic methods. Capability of these methods to search for the global optimum in discrete problems is concerned to achieve final practical design using any available list of structural sections. In this regard, the optimization problem is formulated to achieve minimal weight in tall buildings against gravitational and lateral loadings under codified stress and drift constraints in accordance with the Iranian codes of practice for steel structures (Volume 6 & Volume10). The appropriate steel profiles to use in such structures applied as offered by (Movahed et al., 2014).

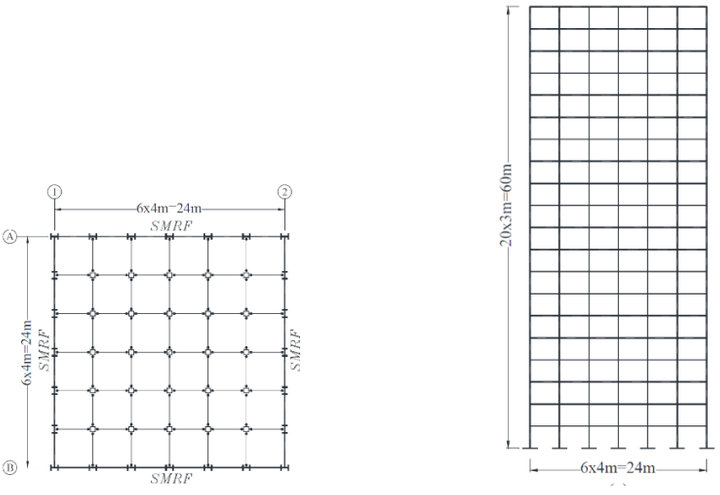

Figure 1. General plan and elevation of 20 story structure (Movahed et al., 2014)

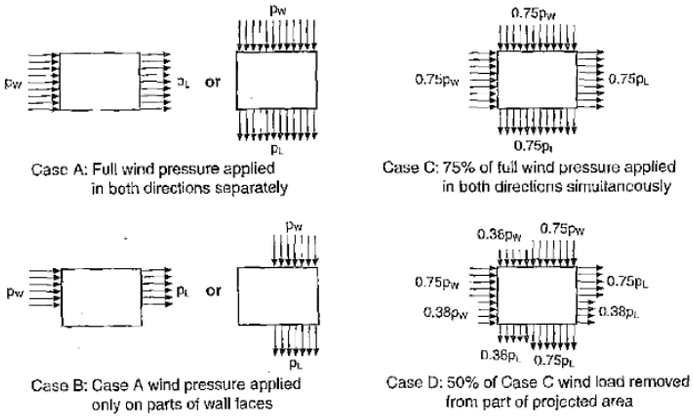

Figure 2. Different wind load cases in Iranian building code (Volume 6)

Examples of three dimensional rigid frames are treated using two types of modelling; first by rigid floors without rotational degrees of freedom and second with both translational and rotational degrees of freedom at every connection. Three meta-heuristics are then employed via comparative study of their performance in this problem; they are *Harmony Search,* HS, *Particle Swarm Optimization,* PSO and recently developed *Mine Blast Optimization,* MBO (Sadollah et al., 2012, 2013). Considerable benefit in material cost minimization is obtained using these algorithms with tuned parameters. As a result, the effectiveness of HS is concluded to be less than the other two. It is also declared that the taller the building, the more computational effort is required to achieve proper convergence in this problem. Meanwhile, MBO sensitivity to parameter tuning is evaluated.

Its results in optimal design are comparable with those by PSO. It is shown that the ratio of displacement to drift constraint can be active in the optimum solution as an important criteria for structural design of tall buildings Treating examples of 10, 15, 20 story three dimensional rigid frames, reveals optimal distributions of stiffness and strength in such tall buildings to successfully withstand lateral loadings such as wind effects.

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