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Optimum Design of Steel Space Frames by Hybrid Teaching-Learning Based Optimization and Harmony Search Algorithms

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Abstract : This study presents a hybrid metaheuristic algorithm to obtain optimum designs for steel space buildings. The optimum design problem of three-dimensional steel frames is mathematically formulated according to provisions of LRFD-AISC (Load and Resistance factor design of American Institute of Steel Construction). Design constraints such as the strength requirements of structural members, the displacement limitations, the inter-story drift and the other structural constraints are derived from LRFD-AISC specification. In this study, a hybrid algorithm by using teaching-learning based optimization (TLBO) and harmony search (HS) algorithms is employed to solve the stated optimum design problem. These algorithms are two of the recent additions to metaheuristic techniques of numerical optimization and have been an efficient tool for solving discrete programming problems. Using these two algorithms in collaboration creates a more powerful tool and mitigates each other's weaknesses. To demonstrate the powerful performance of presented hybrid algorithm, the optimum design of a large scale steel building is presented and the results are compared to the previously obtained results available in the literature.

Keywords : optimum structural design, hybrid techniques, teaching-learning based optimization, harmony search algorithm, minimum weight, steel space frame
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