基因演算法使用爬山與貪婪策略應用於桁架結構最佳化設計

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摘 要

基因演算法是一種在離散數值最佳化問題常被使用最佳化技術。然而基因演算法在處理離散結構最佳化問題時常需要大量的計算量，尤其是當問題解空間潛在的解答數目非常龐大時。傳統基因演算法工作參數設定對於計算結果亦有影響，不佳參數有可能造成計算結果不穩定，不利使用者評估解答是否可靠。本論文主要目的是在基因演算法中加入爬山策略及貪婪想法，讓基因演算法對於工作參數的敏感性降低，並用較少的計算就能獲得穩定且可靠的解答。爬山策略對於基因演算法的主要功能是搜尋空間折減，避免基因演算法浪費時間在探索沒價值的區域；貪婪想法主要功能是協助基因演算法發現有價值的搜尋空間，希望因此降低挖掘解答的時間。為了驗證改良後基因演算法的效能，四個經典的離散尺寸結構最佳化問題被選來測試新演算法。測試結果指出，在相同工作參數下改良基因演算法較傳統基因演算能獲得較穩定且較佳的計算結果。

關鍵字：離散數值最佳化問題、爬山策略、貪婪想法、搜尋空間折減

A hill-climbing and greedy genetic algorithm for the optimal design of truss structures

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ABSTRACT

Genetic algorithms (GAs) are commonly used methods for discrete valued optimization problems. However, GAs often spend a significant amount of computational time in searching for the optimal solution of discrete structural optimization problems, especially when the search space has enormous number of potential solutions. Moreover, GAs are possible perform unstable computational results as the set of bad working parameters is used for them. Therefore, this work attempts to optimize the design of truss structures with discrete sizing variables through an enhanced search performance by incorporating a hill-climbing strategy and two greedy notions into a simple GA. The hill-climbing strategy is integrated into the GA to reduce the search space, while the greedy notions help the GA to explore the search space for identifying the most promising search region. Four truss design problems selected from the literatures are adopted for the performance of tests of the proposed GA. The computational results indicate that the proposed GA has the strong capability and stability for finding the optimal design of truss structures with discrete sizing variables within a small number of iterations.

Keywords: discrete valued optimization problem, a hill-climbing strategy, greedy notions, reduce the search space

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