

## Abstract

Nowadays, the engineering problem systems are large and complex. Effective methods for solving these problems using a finite sequence of instructions can be categorized into optimization and meta-heuristics algorithms. Though the best element from some set of available alternatives cannot be done, meta-heuristics is an alternative for experience-based techniques that rapidly help in problem solving, learning and obtaining a more efficient or more robust procedure. All meta-heuristics provide auxiliary procedures in terms of their own black-box functions. It has been shown that the effectiveness of all meta-heuristics depends almost exclusively on these auxiliary functions. In fact, the auxiliary procedure from one meta-heuristic can be implemented into other meta-heuristics.

A well-known meta-heuristic, harmony search algorithm (HSA), is compared with the shuffled frog-leaping algorithm (SFLA). The HSA is used to produce a near optimal solution under a consideration of the perfect state of harmony of the improvisation process of musicians. The memetic meta-heuristic of the SFLA, based on a population, is a cooperative search metaphor inspired by natural memetics. It includes elements of local search and global information exchange.

This study presents solution procedures via constrained and unconstrained problems with different natures of single and multi peak surfaces including a curved ridge surface. The better algorithm is also modified via the variable neighborhood search method (VNS) philosophy including the super modified simplex method (SMS). The basic idea of the VNS is the change of neighborhoods during searching for a better solution. The VNS proceeds by a descent method to a local minimum exploring then, systematically or at random, increasingly distant neighborhoods of this local solution. The results from both constrained minimization models and non-linear continuous unconstrained functions in the context of response surface methodology show that harmony search algorithm seems to be better in terms of the mean and variance of design points and yields.