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# Multi-Start, Random Reselection of Algorithms or Both?

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**Abstract:** Most state-of-the-art optimization algorithms utilize restart to resample new initial solutions to avoid the premature convergence problem. However, resampling is not the only way to avoid this problem. Moreover, initial solutions are not the only cause for premature convergence. Starting from the same set of initial solutions cannot always lead to the same local optimum even when using the same stochastic search method. Here, using a different search algorithm may help to escape local optima. This paper investigates the effectiveness of random selection of a new search algorithm instead of resampling a new initial solution to overcome the premature convergence problem. Selecting a new search algorithm randomly and keeping the same initial solution is compared with sampling a new solution and keeping the same algorithm. The effectiveness of random selection a new algorithm to free solutions that are trapped in local optima is also studied. A number of experiments were conducted to evaluate the success of different random selection approaches in reaching a global optimum. The noise-free BBOB-2010 test suite was used to benchmark different sampling approaches. The results demonstrate the effectiveness of random selection of new algorithms over resampling new initial solutions on a range of optimization problems. Random selection of a new algorithm can improve the success rate by more than 10% compared with that of the best algorithm.

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## ☰ Contents

### I. Introduction

Local search methods are often combined with random restarts for global optimization [1]. Restarts can help local search methods to avoid being trapped in a local optimum instead of locating the global optimum [2]. This problem is usually referred to as the premature convergence problem [3]. Restarts can be used to boost the performance of local search methods [4]. They can also help avoiding slow search progress by starting from potentially better solutions [5]. Restarts enable discovering multiple local solutions and improve the ability to locate a global optimum [6].

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