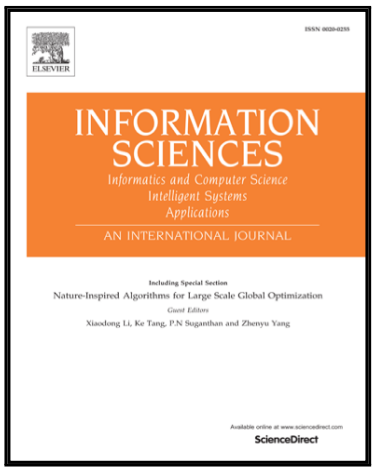

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PII: S0020-0255(16)32090-4
DOI: 10.1016/j.ins.2016.12.028
Reference: INS 12663

To appear in: *Information Sciences*

Received date: 22 April 2016
Revised date: 14 December 2016

Please cite this article as: Adam P. Piotrowski , Maciej J. Napiorkowski , Jaroslaw J. Napiorkowski , Pawel M. Rowinski , Swarm Intelligence and Evolutionary Algorithms: performance versus speed, *Information Sciences* (2016), doi: 10.1016/j.ins.2016.12.028

Swarm Intelligence and Evolutionary Algorithms: performance versus speed

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ABSTRACT:

The popularity of metaheuristics, especially Swarm Intelligence and Evolutionary Algorithms, has increased rapidly over the last two decades. Numerous algorithms are proposed each year, and progressively more novel applications are being found. However, different metaheuristics are often compared by their performance on problems with an arbitrarily fixed number of allowed function calls. There are surprisingly few papers that explore the relationship between the relative performance of numerous metaheuristics on versatile numerical real-world problems and the number of allowed function calls.

In this study the performance of 33 various metaheuristics proposed between 1960 and 2016 have been tested on 22 numerical real-world problems from different fields of science, with the maximum number of function calls varying between 5000 and 500,000. It is confirmed that the algorithms that succeed in comparisons when the computational budget is low are among the poorest performers when the computational budget is high, and vice versa. Among the tested variants, Particle Swarm Optimization algorithms and some new types of metaheuristics perform relatively better when the number of allowed function calls is low, whereas Differential Evolution and Genetic Algorithms perform better relative to other algorithms when the computational budget is large. It is difficult to find any metaheuristic that would perform adequately over all of the numbers of function calls tested. It was also found that some algorithms may become completely unreliable on specific real-world problems, even though they perform reasonably on others.

Keywords:

Convergence speed, Genetic Algorithm, Differential Evolution, Particle Swarm Optimization, Biogeography-based Optimization, Direct Search method.

1. Introduction