Abstract

The performance of Metaheuristics in general and Evolutionary Algorithms (EA) in particular depends on good settings of algorithm parameter values, such as population size, mutation rate or crossover probability. To increase performance, researchers still try to find optimal settings. At present, researchers are adapting the parameter settings during an evolutionary run (parameter control). Thus, no hand tuning is needed upfront of an evolutionary run. In this paper we analyze algorithm performance when using adaptable algorithm parameters on Genetic Algorithms (GA) with multi-chromosome representation. Most of the research in the field of EA has been done on a theoretical basis. Often the proposed solutions do not deliver what they promise, when applying them to complex problems of real-world. Thus, experimental studies on complex problems of real-world are needed to ascertain performance improvement of adaptive parameter control. This paper is an experimental study on such a complex optimization problem of real-world (dynamically coupled System of Systems). In our approach of parameter control new individuals are generated by adapting the mutation rate. Therefore, we calculate a
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dedicated mutation rate for each chromosome of the individual. This happens in relation to the fitness of each chromosome. We analyzed and have statistically proven the outperformance of our approach upfront with the De Jong’s (Sphere) and the Schwefel’s test function. In this paper, we are now applying our approach to a real world based complex optimization problem (nonstationary, dynamic, noisy), to prove the outperformance of our approach. Therefore, we made a performance comparison with non-adaptive GA, which demonstrates the superiority of the adaptive approach. More specifically, we use a stochastic simulation model of university hospital processes. Inpatient admission, outpatient admission and op-theater planning of elective patients must be optimized simultaneously, while emergencies occur. Every hospital area has its own objectives and constraints (dedicated systems). The number of patients and utilization of resources must be maximized in every hospital area, while waiting times, lead times and schedule variances must be minimized. In that, a system of systems can be seen. It is shown how our approach can be used to optimize such dynamically coupled system of systems (SoS) in an efficient way.

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Index Terms

Computer Science  Artificial Intelligence

Keywords

Genetic algorithms, hospital, inpatient admission, multi-chromosome, mutation rate, op-theater planning, optimization, outpatient admission, parameter control, self-adapting, computer simulation, real world problem, system of systems optimization.