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A FAST PARTICLE SWARM OPTIMIZATION

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Abstract. *Particle swarm optimization (PSO) is a popular and robust strategy for optimization problems. One main difficulty in applying PSO to real-world applications is that PSO usually need a large number of fitness evaluations before a satisfying result can be obtained. This paper introduces a new "fast particle swarm optimization" (FPSO) that does not evaluate all new positions owning a fitness and associated reliability value of each particle of the swarm and the reliability value is only evaluated using the true fitness function if the reliability value is below a threshold. Moreover, applying random evaluation, reliability value update and self-adaptive threshold strategies to the FPSO further enhances the performance of the algorithm.*
Keywords: Particle swarm optimization,random evaluation, Self-adaptive threshold, Reliability value update strategy, Convex combination

1. **Introduction.** Particle swarm optimization (PSO) is a new population-based evolutionary computation method first proposed by Kennedy and Eberhart [1,2]. Because of the ease of implementation and the fact that no gradient information is required, it has been used to solve many different optimization problems, such as neural network training [3,4], data mining [5,6],web content organizing [7], traffic incident detection [8], etc.

Numerous improvements to the standard PSO have been proposed. Some are focusing the rate of convergence, while the others are diversity. One of the most widely used improvement is the introduction of the inertia weight [9] that can be seen as the equivalent of a temperature schedule in the simulated annealing algorithm. To ensure convergence, Clerc indicated a constriction factor model which is a way of choosing the values of some parameter coefficients [10]. Inspired by the power of evolutionary computation techniques, several versions of PSO with selection, reproduction and recombination and Gaussian mutation operators are introduced by Angeline [11], Løvbjerg [12], Higashi and Iba [13] respectively. For tackling the overshooting problem in the motion behavior of PSO, a novel variant of PSO named memetic particle swarm optimization algorithm is proposed [14]. When PSO with multiple swarms is applied to solve an optimization problem, many factors influence the working separately and cooperating with each other. Abd and Kamel