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ADAPTIVE PARTICLE SWARM OPTIMIZATION USING VELOCITY FEEDBACK

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Abstract. *The Particle Swarm Optimization (PSO) method is one of the most powerful methods available for solving both unconstrained and constrained global optimization problems. However, the knowledge of adaptive strategies for tuning the parameters of the method for application to large-scale nonlinear non-convex optimization problems is still very limited. This paper describes an adaptive strategy for tuning the parameters of the PSO method by analyzing the dynamics of PSO. This adaptive tuning strategy is based on the results of analysis of the dynamics of the average velocity of particles with successful search processes. The feasibility and advantages of the proposed adaptive PSO method are demonstrated through numerical simulations using two types of typical global optimization test problems.*

Keywords: Global Optimization, Metaheuristics, Swarm Intelligence, Particle Swarm Optimization

1. **Introduction.** The Particle Swarm Optimization (PSO) method is one of the most powerful methods available for solving unconstrained and constrained global optimization problems. The method was originally proposed by J. Kennedy et al. as an optimization method in 1995. Subsequent numerical experiments have demonstrated that the PSO method is efficient for a variety of global optimization problems with nonlinear and multi-peaked features, see for example, [1],[2],[3] and the references therein.

Metaheuristics, which include the PSO method, are approximate algorithms designed to be applied to engineering problems. It is clearly desirable that these algorithms should be applicable to real optimization problems without the need for highly skilled labor. However, to date their application requires significant time and labor for tuning the parameters, and so, from an engineering viewpoint, it is desirable to add the robustness and adaptability to these algorithms.

The robustness of an optimization method describes the degree to which the method can guarantee the performance of search for pre-adjusted parameters against the predetermined structural variation of problems to be solved. The adaptability of an optimization method describes the method's ability to adaptively adjust its parameters against predetermined structural variation of the problems to be solved.

The latter adaptability property is especially important from the viewpoint of practical application. Two significant relationships must be understood in order to add adaptability