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AN EFFICIENT FINE-GRAINED PARALLEL PARTICLE SWARM OPTIMIZATION METHOD BASED ON GPU-ACCELERATION

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Abstract. *Fine-grained parallel particle swarm optimization (FGPSO), though a popular and robust strategy for solving complicated optimization problems, is sometimes inconvenient to use as its population size is restricted by heavy data communication and the parallel computers are relatively difficult to use, manage, maintain and may not be accessible to most researchers. In this paper, we propose a FGPSO method based on GPU-acceleration, which maps a parallel PSO algorithm to texture-rendering on consumer-level graphics cards. The analytical results demonstrate that the proposed method increases the population size, speeds up its execution and provides ordinary users with a feasible FGPSO solution.*
Keywords: Particle swarm optimization, Fine-grained, Parallel process, GPU

1. **Introduction.** The Particle Swarm Optimization (PSO) is one of the most powerful methods available for solving unconstrained and constrained global optimization problems [1]. In the past few years, PSO algorithms have been successfully applied in many different application areas owing to its robustness and simplicity [2-4]. Although PSO algorithms are rather effective in solving many practical problems, they have to run a long time to find solutions to huge problems as several fitness evaluations must be performed. To overcome this limitation, researchers have proposed some methods for improvement, such as the adaptive PSO using velocity feedback of N. Iwasaki [5] and the fast PSO of Z. Cui [6]. Recently a more promising approach has attracted a lot of attention which parallelizes these algorithms for parallel, distributed, and networked computers [7-10].

Fine-grained parallel PSO algorithm (FGPSO) is an important model of parallel PSO algorithms [11-13]. It has advantages of maintaining better population diversity, inhibiting premature and keeping the utmost parallelism. FGPSO is able to outperform all other PSO algorithms when dealing with high-dimensional variable spaces [11]. The current FGPSO is mostly implemented on parallel, distributed, and networked computers. Despite all its merits, FGPSO has brought the users a lot of inconvenience due to the following drawbacks: (1) FGPSO for complicated optimization problems often requires hundreds of particles, and the heavy data communication is hardly acceptable in most parallel machines; (2) Parallel machine equipment is relatively more difficult to use, manage, and maintain; and (3) some people may not have access to this kind of computer.