

# A Flexible Implementation of the PSO Algorithm for Fine- and Coarse-Grained Reconfigurable Embedded Systems

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**Abstract**—The large execution times demanded for solving complex optimization problems in embedded systems is one of the main challenges in the field of engineering optimization. One solution is the acceleration by a specialized hardware implementation. However, this is coming along with a loss of flexibility especially for the realization of the application-specific fitness function. In this paper we present novel solutions for the flexible implementation of the Particle Swarm Optimization (PSO) algorithm by targeting the coarse-grained reconfigurable Kahrisma architecture. Effectiveness of the proposed solutions was demonstrated for benchmark test problems by numerical simulations achieved by Kahrisma and the MicroBlaze soft-core processor mapped on fine-grained reconfigurable technology using the Open Virtual Platform (OVP) simulator as well as an FPGA implementation. Convergence results demonstrate that the proposed solutions achieve the optimal points for different scenarios. Finally, execution time results demonstrate that the Kahrisma implementation with 4-issue width provides the required flexibility to design high performance embedded optimization systems.

**Index Terms**—Optimization engines; swarm intelligence; fine-grain; coarse-grain; FPGAs;

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