An Efficient Particle Swarm Optimization for Large-Scale Hardware/Software Co-Design System

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1. Introduction

Co-design is one area of cooperative information process, system and application (CIPSA).\textsuperscript{1–3} Optimization approach is necessary in CIPSA.\textsuperscript{4–7} An efficient optimization approach is very important for large-scale CIPSA.\textsuperscript{8}

Hardware/software (HW/SW) partitioning is a key step in HW/SW co-design system. HW/SW partitioning decides which tasks of the system should be implemented in hardware and which ones in software. Implementation with software module has more flexibility and needs less cost, but more executing time, and vice
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In the co-design process of hardware/soft (HW/SW) system, especially for large and complicated embedded systems, HW/SW partitioning is a challenging step. Among different heuristic approaches, particle swarm optimization (PSO) has the advantages of simple implementation and computational efficiency, which is suitable for solving large-scale problems. This paper presents a conformist particle swarm optimization with firework explosion operation (CPSO-FEO) to solve large-scale HW/SW partitioning. First, the proposed CPSO algorithm simulates the conformist mentality from biology research. The CPSO particles with psychological conformist always try to move toward a secure point and avoid being attacked by natural enemy. In this way, there is a greater possibility to increase population diversity and avoid local optimum in CPSO. Next, to enhance the search accuracy and solution quality, an improved FEO with new initialization strategy is presented and is combined with CPSO algorithm to search a better position for the global best position. This combination can keep both the diversified and intensified searching, at last, the experiments on benchmarks and large-scale HW/SW partitioning demonstrate the efficiency of the proposed algorithm.

Keywords:
Hardware/software partitioning; particle swarm optimization; firework explosion operation; communication cost; parallel computing

KeyWords Plus: HARDWARE SOFTWARE COSYNTHESIS; FIREWORK BASED SYNCHRONIZATION METHOD; GENETIC ALGORITHM; COLLABORATIVE DESIGN; SEARCH ALGORITHMS; CAD SYSTEMS; SEGMENTATION; SELECTION; CODESIGN; THERAPY

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