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COEVOLUTIONARY OPTIMIZATION ALGORITHM WITH DYNAMIC SUB-POPULATION SIZE

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Abstract. *This paper proposes a coevolutionary optimization algorithm called DCOA. DCOA mainly focuses on how to adjust sub-population size self-adaptively so as to improve the optimizing performance. To achieve this, a strategy is introduced which consists of three rules: internal competition, external competition and spontaneous growth rules. These rules can control individual reproduction and elimination speed in each sub-population. Furthermore, the adjustment can be proven globally asymptotically stable. In the experiments, we compare the performances of DCOA, macroevolutionary algorithm (MA) [13] and simple genetic algorithm (SGA) with typical test functions. The results show that DCOA is able to find the global optimum on most difficult functions, nothing less than MA which uses simulated annealing technique. At the same time, DCOA converges quickly, similar to SGA and faster than MA.*

Keywords: Coevolutionary optimization algorithm, Dynamic population size, Global asymptotic stability

1. **Introduction.** Evolution-based algorithms have been widely used for the optimization problems in recent years, and many promising results have been obtained [1-4]. Among the existing evolution-based optimization algorithms, coevolutionary optimization is a new technique which divides the set of individuals into several sub-populations and makes them co-evolve in a dependent manner. The search space is also divided into several subspaces called niches, and information integrates between the niches at the individual level over generations. Coevolutionary algorithms have many interesting features compared with other evolution-based algorithms, such as specialization, generalization and efficiency. These features give coevolutionary algorithm great potential in solving various optimization problems.

Population size is one of the key factors in an evolution-based algorithm because it determines the size of population state space and then affects the algorithm's convergent performance. If the population size is too small, the algorithm may suffer from premature