

## **Evolving opposition-based pareto solutions: multiobjective optimization using competitive coevolution**

### **Abstract**

Recently a number of researchers have begun exploring the idea of combining Opposition-Based Learning (OBL) with evolutionary algorithms, reinforcement learning, neural networks, swarm intelligence and simulated annealing. However, an area of research that is still in infancy is the application of the OBL concept to coevolution. Hence, in this chapter, two new opposition-based competitive coevolution algorithms for multiobjective optimization called SPEA2-CE-HOF and SPEA2-CE-KR are discussed. These hybrid algorithms are the combination of Strength Pareto Evolutionary Algorithm 2 (SPEA2) with two types of the competitive fitness strategies, which are the Hall of Fame (HOF) and  $K$ -Random Opponents (KR), respectively. The selection of individuals as the opponents in the coevolutionary process strongly implements this opposition-based concept. Scalability tests have been conducted to evaluate and compare both algorithms against the original SPEA2 for seven Deb, Thiele, Laumanns, and Zitzler (DTLZ) test problems with 3 to 5 objectives. The experimental results show clearly that the performance scalability of the opposition-based SPEA2-CE-HOF and SPEA2-CE-KR were significantly better compared to the original non-opposition-based SPEA2 as the number of the objectives becomes higher in terms of the closeness to the true Pareto front, diversity maintenance and the coverage level