

Multiple Objective Evolutionary Algorithms for Independent Computationally Expensive Objective Evaluations

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Abstract

Multiple Objective Evolutionary Algorithms (MOEAs) are superior to other optimization techniques when the search space is of high dimension and contains many local minima and maxima. Likewise, MOEAs are most interesting when applied to non-intuitive complex systems. But, these systems are often computationally expensive to calculate. When these systems require independent computations to evaluate each objective, the computational expense grows with each additional objective. This research has developed methods that reduces the time required for evolution by reducing the number of objective evaluations, while still evolving solutions that are Pareto optimal. To date, all other MOEAs require the evaluation of all objectives before a fitness value can be assigned to an individual.

This research augments current MOEAs with original methods that dramatically reduce the time required to evolve toward a region of interest in objective space. The original methods are: Linear Interpolated Data Transformation Scaler, Hypercube Distance Scaler, Dynamic Objective Thresholding, Dynamic Objective Ordering and removal of generation synchronization. The performance of these methods are measured using a flare pattern design problem. Selected methods are then used in the real world problem of optimization of AAR-44 Missile Warning Receiver Optimization.

Bio

Greg Rohling completed his Bachelors in Electrical Engineering from Georgia Tech in 1988, and his Masters also in Electrical Engineering from Georgia Tech in 1989. After graduation he began work with Georgia Tech Research Institute (GTRI), in the development of simulations for the countermeasures for missile threats. From 1992 to 1995 he worked for a small company, TimePlus, in the development of real-time data acquisition for radar data. In 1995 he rejoined GTRI continuing in variety of programs requiring simulation of IR threats and countermeasures. He enrolled as a part-time student at Georgia Tech in 1997. In 1999 he discovered the area of Genetic Algorithms that ultimately resulted in a non-orthogonal alignment of his thesis vector with his work vector. Since graduating with his Ph.D. in Electrical and Computer Engineering in December of 2004, he has continued application of MOEA methods to optimization of the AAR-47 missile warning receiver, flare pattern design and erythema detection with GTRI.