On Optimized Crossover in Genetic Algorithms

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In this talk, we will consider the effect of the optimized crossover within the framework of Genetic Algorithms (GAs) and look at some cases where this procedure is performed efficiently. The optimized crossover operator finds the best possible offspring (with respect to the solutions encoding) in a crossover, given two solutions of the parents.

The well-known optimized crossover operator for the maximum clique problem [1] is taken as a starting point. By means of efficient reductions we show [4] the polynomial solvability of the optimized crossover problems for the set packing, set partition and simple plant location problems, assuming the solution encodings of the standard Boolean programming formulations [5]. The optimized crossover for the set cover problem with the *non-binary* representation of solutions [2] can be performed efficiently as well.

Many computational results indicate improved performance of the GAs with optimized crossover (see e.g. [1]). We will consider this on the example of the Supply Management Problem with Lower-Bounded Demands (SMPLD). The problem consists in planning the shipments from a set of providers to a set of consumers minimizing the total transportation cost, given lower and upper bounds on shipment sizes, lower-bounded consumption and linear delivery costs. In this case the optimized crossover problem is NP-hard. Integration of CPLEX 9.0 MIP-solver into the crossover operator results in a GA, outperforming the stand-alone CPLEX and a greedy algorithm-based GA [3]. Introduction of the Benders cuts into the MIP crossover problem yields a statistically significant improvement in solutions quality.

References

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