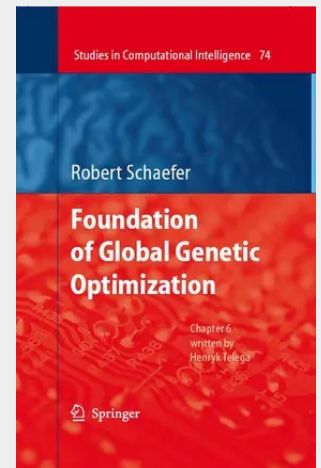


Foundations of Global Genetic Optimization

Genetic algorithms today constitute a family of effective global optimization methods used to solve difficult real-life problems which arise in science and technology. Despite their computational complexity, they have the ability to explore huge data sets and allow us to study exceptionally problematic cases in which the objective functions are irregular and multimodal, and where information about the extrema location is unobtainable in other ways. They belong to the class of iterative stochastic optimization strategies that, during each step, produce and evaluate the set of admissible points from the search domain, called the random sample or population. As opposed to the Monte Carlo strategies, in which the population is sampled according to the uniform probability distribution over the search domain, genetic algorithms modify the probability distribution at each step. Mechanisms which adopt sampling probability distribution are transposed from biology. They are based mainly on genetic code mutation and crossover, as well as on selection among living individuals. Such mechanisms have been tested by solving multimodal problems in nature, which is confirmed in part by the many species of animals and plants that are well adapted to different ecological niches. They direct the search process, making it more effective than a completely random one (search with a uniform sampling distribution). Moreover, well-tuned genetic-based operations do not decrease the exploration ability of the whole admissible set, which is vital in the global optimization process. The features described above allow us to regard genetic algorithms as a new class of artificial intelligence methods which introduce heuristics, well tested in other fields, to the classical scheme of stochastic global search.

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