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Abstract

Theory of Simple Genetic Algorithms

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In this thesis, we study and summarize the theory of Vose's simple genetic algorithm. We systematically demonstrate the algebraic model of genetic algorithm operations with detailed proofs and examples.

Then the Markov chain model for Vose's finite population genetic algorithm is illustrated. We analyze the asymptotic behavior of it based on classical Markov chain theory.

Mainly, we study the theory of random heuristic search and show Vose's simple genetic algorithm as a special case of it. We design an example to illustrate the framework and give detailed proofs for basic theoretical results. Moreover, we investigate the transient behavior of random heuristic search. Also, we show that a random heuristic search can induce a Markov chain.

Finally, The Walsh transform is employed to investigate the spectrum of the differential of the mixing function, which is related to the asymptotical behavior of Vose's simple genetic algorithm. Original proofs are included in it.