

## Genetic Algorithm to optimize the operation of column sequence

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Genetic Algorithms (GAs) are stochastic global search and optimization techniques that mimic the mechanism of natural selection and evolution<sup>[1,2]</sup>. Our present work is to apply Genetic Algorithms to optimize the operation of a sequence of distillation columns.

Column parameters, such as minimum reflux and product specifications, can be optimized economically and scientifically by GAs. We use real number chromosomes to encode the problems. Basing on the initial individual chromosomes invented randomly within different definitions, children chromosomes are cultivated by arithmetic crossover and nonuniform dynamic mutation. In order to make sure each chromosome is feasible for the distillation column sequence, feasibility test is combined into the GAs. Feasibility and product specifications are constraints evaluated by punishment functions. Punishment to those chromosomes who are feasible and within product specification is zero. The more infeasible and far away from product specifications, the more punishment. Chromosomes' fitness is determined by their weighted reflux and punishment of feasibility and product specifications. Chromosomes used to generate offspring are selected according to their fitness by tournament selection method and elitism selection method, the less fit the chromosomes are, the less likely that they are to be selected.

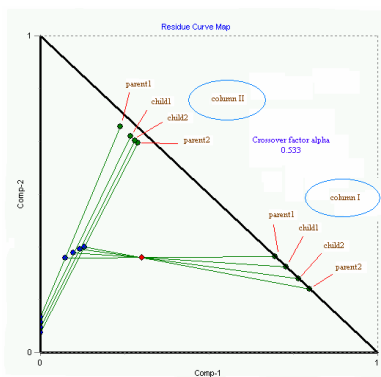


Figure 1 Chromosome crossover

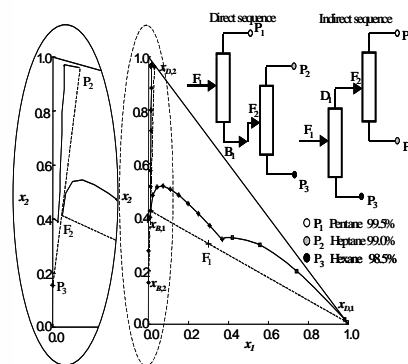


Figure 2 Feasibility test

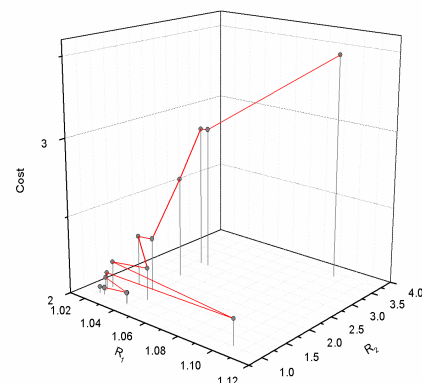


Figure 3 Convergence of our GAs

[1] Goldberg, D., *Genetic Algorithms in Search, Optimization and Machine Learning*, Addison-Wesley, Reading, MA, 1989.

[2] Michalewicz, Z., *Genetic Algorithm + Data Structure = Evaluation Programs*, 2<sup>nd</sup> ed., Springer-Verlag, New York, 1994.